doi : 10.17596/0003080

Onboard Report

of

the R/V *Natsushima*/ROV *Hyper-Dolphin* Cruise

in Sagami Bay (NT12-15)

June 21 – June 24, 2012

Japan Agency for Marine-Earth Science and Technology

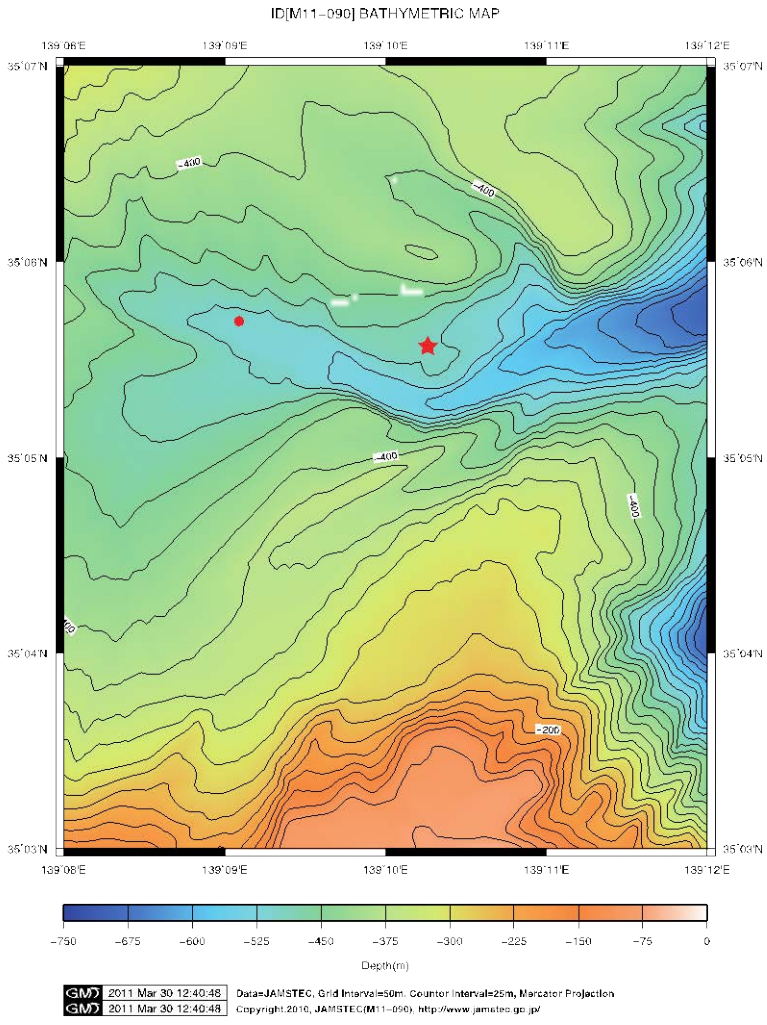
(JAMSTEC)

ABSTRACT

To elucidate faunal succession and decomposition process of a whale carcass, an ROV diving research was conducted in Sagami Bay. A baby sperm whale (5 m in total length) was submerged at a depth of 500 m in the bay on June 8, 2012. More than 40% of the soft tissues were consumed within 2 weeks from the deployment. Most dominant consumers were eels and crustaceans from the ROV observations. For long-term observations and analyses, two time-lapse cameras and two sediment traps were deployed around the carcass. Additionally, 3D mapping around the whale was conducted.

Cruise Information

Cruise ID: NT12-15
Name of vessel: R/V *Natsushima*/ROV *Hyper-Dolphin 3000*
Title of the cruise: IMPACTO (IMPlantation of Animal Carcasses for Time-series Observations)-2
Title of proposal: Implantation of animal carcasses for time-series observations
Cruise period: June 21, 2012 - June 24, 2012
Chief scientist [Affiliation]: Yoshihiro FUJIWARA [JAMSTEC]
Representative of the Science Party [Affiliation]: Yoshihiro FUJIWARA [JAMSTEC]
Ports of call: from JAMSTEC port (Yokosuka) to JAMSTEC Port (Yokosuka)
Research area: Sagami Bay
Research map: Dive site is shown as★.



I. Participants aboard

1-1. Research group

Yoshihiro FUJIWARA	JAMSTEC
Masaru KAWATO	JAMSTEC
Norio MIYAMOTO	JAMSTEC
Masayuki MIYAZAKI	JAMSTEC
Jun TANADA	JAMSTEC
Ayami IKENOBE	JAMSTEC
Natsumi KASAI	JAMSTEC
Shiori HORIE	JAMSTEC
Kihachi HASEBE	JAMSTEC
Adrian BODENMANN	University of Tokyo
Tomoko TAKAHASHI	University of Tokyo
Reyes Tatsuru SHIRAKU	University of Tokyo
Yuji ONISHI	Okayama University
Yoshio YUKI	NHK
Katsuhiko TAKANO	NHK
Kazuhiko KOSAI	Matsuken., Inc.
Keizo IZUTA	NHK
Satomi MINAMIZAWA	Nippon Marine Enterprises, LTD.

1-2. Operation team of the ROV Hyper-Dolphin

Submersible Operation Manager	Homare Wakamatu
Deputy Submersible TechnicalManager	Kazuhiro Chiba
1st Submersible Technical Officer	Mitsuhiro Ueki
2nd Submersible Technical Officer	Yudai Sakakibara
2ndSubmersible Technical Officer	Shigeru Kikuya
2nd Submersible Technical Officer	Atsushi Takenouchi
2nd Submersible Technical Officer	Ryo Saigo
3nd Submersible Technical Officer	Daichi Urata

1-3. Captain and crew of the R/V Natsushima

Captain	Hitoshi Tanaka
Chief Officer	Naoto Kimura
2nd Officer	Masato Chiba
3rd Officer	Motoi Katsumata
Chief Engineer	Minoru Tsukada
1st Engineer	Naohito Tadooka
Jr. 1stEngnieer	Koji Funae
2nd Engineer	Takahiro Mori
3rd Engineer	Hozumi Kuratomi
Chief Electronic Operator	Yoichi Inoue
2ndElectronic Operator	Yohei Yamamoto
Boat Swain	TadahikoToguchi
Able Seaman	Yasuo Konno
Able Seaman	Nobuyuki Ichikawa
Able Seaman	Yoshiaki Matsuo
Able Seaman	Hiroaki Murase
Sailor	Kazuho Ikeda
Sailor	Yasunobu Kawabe
No.1 Oiler	Masaru Kitano

Oiler	Katsuyuki Yoshida
Oiler	Ryota Suzuki
Assistant Oiler	Taijyun Iwao
Assistant Oiler	Aoi Takamiya
Chief Steward	Ryuei Takemura
Steward	Shinsuke Tanaka
Steward	Hiroyuki Ohba
Steward	Tatsuya Yamamoto
Steward	Katsuhiro Kawase

2. Proposals

2-1. Comprehensive proposal

Yoshihiro FUJIWARA
(JAMSTEC)

The main purpose of this diving cruise is to describe an early succession of whale-fall ecosystems at a depth of 500 m in Sagami Bay. A stranded carcass of a sperm whale calf was deployed off Atami City in Sagami Bay on June 8, 2012. During this cruise, we would like to measure a consumption rate of the whale carcass and faunal diversity at this location two weeks after the deployment. In addition, we will deploy several time-lapse video camera and sediment traps around the carcass. This project is under collaboration with NHK and Discovery Channel for broadcasting.

2-2. Respective proposals (each researcher)

Adrian BODENMANN
(Ura Laboratory, The University of Tokyo)

During this cruise our goal is to generate an accurate, high-resolution 3D model in colour of the whale carcass and the surrounding area. We aim to do so using different methods, where data is recorded from low altitude to generate high-resolutions maps, as well as from middle and high altitudes to cover large areas in short time. The low range, high resolution mapping method has been successfully applied for mapping of the seafloor on multiple cruises in the past. This time will be the first time to apply it on a biological target and we plan to use the data for calculating the volume of the carcass.
We also aim to perform middle and long range mapping for the first time at sea, for which we made a modified version of our mapping device using two high sensitivity cameras and four synchronised flashes. With this method we expect to significantly increase the mapped area while reducing the required time to record the data.

Masayuki MIYAZAKI
(JAMSTEC)

Succession of microbial diverse and taxonomic studies in whale-fall community

The carcass of the baby sperm whale was thrown with a research purpose about the whale fall ecosystems in the deep-sea bottom. There is cold seep of Sagami Bay around this sea area, and the chemosynthetic organisms of the wide variety are living. Whale falls have been thought to be ‘stepping stones’ not only for dispersal of deep-sea chemosymbiotic species but also for the introduction over evolutionary time of chemoautotrophy-dependent invertebrates to vent and seep environments (Smith et al. 1989). The medium to isolate the normal marine bacteria was used with a whale fall off Noma-misaki. However, about 30% of the whole showed the possibility of the new species. For this reason, this environment is better suited for screening of useful microorganism. The principal aims of this study are to (i) clarify succession of microorganism by phylogenetic analysis of SSU-rRNA gene in whale fall communities, and (ii) isolate of anaerobic useful microorganisms.

Yuji ONISHI
(Okayama University)

To research the nutrient source of organisms and understand carbon, nitrogen and sulfur cycles around a whale-fall, I will conduct the isotope analysis on the samples of organisms collected during this NT12-15 cruise. By comparing the analytical result of the samples of organisms from whale-fall, I consider nutrient source of animals inhabited around whale bones.

3. Dive survey results

3-1. Dive list

Dive # Date	Main purposes	Site	Landing Leaving bottom	Latitude (N)	Longitude (E)	Depth (m)
#1392	Observation of a sperm whale carcass	SAITO	11:59	35-05.577‘N	139-10.175‘E	480
2012/6/22			12:44	35-05.586‘N	139-10.090‘E	450
#1393	Observation of a sperm whale carcass	SAITO	17:44	35-05.586‘N	139-10.287‘E	491
2012/6/22			18:12	35-05.571‘N	139-10.277‘E	489
#1394	Observation of a sperm whale carcass	SAITO	10:03	35-05.572‘N	139-10.263‘E	487
2012/6/23			12:22	35-05.553‘N	139-10.265‘E	487
#1395	Observation of a sperm whale carcass	SAITO	15:14	35-05.554‘N	139-10.250‘E	488
2012/6/23			18:01	35-05.571‘N	139-10.265‘E	489

3-2. Preliminary results (each researcher in charge)

Dive number: HD#1392
Date: June 22, 2012
Site: “Saito” site in Sagami Bay
Chief observer: Yoshihiro FUJIWARA (JAMSTEC)
Main purposes: Deployment of instruments and 3D mapping of the whale “Saito”
Payload equipment:

1. Time-lapse video camera system (V2)	1
2. Sediment trap (No.1)	1
3. Suction sampler & single canister	1
4. MBARI corer	2
5. Niskin bottle	1
6. Recovery hook	1
7. Rope cutter	2
8. SeaXerocks	1

Dive summary

Two ropes were observed on the bottom just after landing on the deep-sea floor. To avoid being entangled in the ropes, Hyper-dolphin took off the bottom at an altitude of 30 meters. Soon after the restart of migration at the altitude, another rope was tangled with the backside of Hyper-Dolphin. During ascent, the rope was released and Hyper-Dolphin was recovered safely onboard.

Sampling & marker points

(1) Rope on bottom 35°05.577’N, 139°10.175’E, Depth: 481 m

Dive number: HD#1393
Date: June 22, 2012
Site: “Saito” site in Sagami Bay
Chief observer: Masaru KAWATO (JAMSTEC)
Main purposes: Removal of ropes for the safety of subsequent dives and observation of a “Saito” whale and whale vertebra
Payload equipment:

9. Rope cutter	2
10. Suction sampler & single canister	1
11. MBARI corer	2
12. Niskin bottle	2
13. Recovery hook	2

Dive summary

The purpose of this cruise was to remove the ropes if there were near the all deployments. Fortunately no ropes were observed around the ‘Saito’ whale, whale vertebra and the point where the sinker of the buoy was deployed during last cruise. After confirmation of the safety, ‘Saito’ whale and 4 sunken vertebrae could be observed by Hyper-Dolphin. A lot of eels and a spider crab were eating ‘Saito’. No big shark appeared near the both whale sites during this dive. Sediment and water sampling using MBARI corers and Niskin bottles were conducted just near the ‘Saito’ and approximately 50m away from the whale site (as control samples). Eels were collected around the head of ‘Saito’ by the suction sampler.

Sampling & marker points

(1)	'Saito'	35°05.572'N, 139°10.262'E, Depth: 487 m
(2)	Whale vertebrae	35°05.548'N, 139°10.262'E, Depth: 488 m
(3)	Water sampling by Niskin	35°05.583'N, 139°10.292'E, Depth: 488 m
(4)	Sediment sampling by MBARI corer	35°05.586'N, 139°10.297'E, Depth: 491 m
(5)	Water sampling by Niskin, sediment sampling by MBARI corer, Biological sampling using suction sampler	35°05.572'N, 139°10.262'E, Depth: 489 m

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Dive number: HD#1394
Date: June 23, 2012
Site: "Saito" site in Sagami Bay
Landing: Time: 10:03, Lat: 35°05.573'N, Long: 139°10.264'E, Depth: 487 m (WGS84)
Leaving: Time: 12:22, Lat: 35˚05.552'N, Long: 139˚10.264'E, Depth: 489m (WGS84)
Chief observer: Arian Bodenmann (the University of Tokyo)
Main purposes: Sampling of seawater and sediments of the seafloor near the whale "*Saito*"
Payload equipment:

14.	Time-lapse video camera system (V2)	1
15.	Sediment trap (No.1)	1
16.	Suction sampler & single canister	1
17.	MBARI corer	2
18.	Niskin bottle	2
19.	Recovery hook	1
20.	Rope cutter	2

Dive summary

The right manipulator of Hyper-Dolphin did not work and the operations were done by only one.

A time lapse camera and a sediment trap were deployed and the whale was filmed. There were a lot of conger eels feeding from the whale and a giant crab was sitting on the head. In leaving for a different site, where there was a vertebra of another whale, the whale was mapped at an altitude of 3.5 m. Seawater and sediments of the seafloor were sampled using Niskin bottles and MBARI corers near the whale and the vertebra. Before leaving, a time lapse camera was retrieved.

Sampling & marker points

(1)	Time-lapse camera (V2) deployment	35.05.573N 139.10.264E, Depth: 488 m
(2)	Sediment trap No.1 deployment	35.05.569N 139.10.261E, Depth: 488 m
(3)	Water sampling by Niskin	35.05.578N 139.10.268E, Depth: 488 m
(4)	Sediment sampling by MBARI corer	35.05.578N 139.10.265E, Depth: 488 m
(5)	3D mapping (ALT: 3.5 m)	35.05.500N 139.10.265E, Depth: 484 m
(6)	Water sampling by Niskin	35.05.552N 139.10.204E, Depth: 488 m
(7)	Sediment sampling by MBARI corer	35.05.551N 139.10.203E, Depth: 488 m
(8)	Recovery of timer cam	35.05.552N 139.10.264E, Depth: 489 m

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Dive number: HD#1395
Date: June 23, 2012
Site: "Saito" site in Sagami Bay

Chief observer: Yoshio YUUKI (NHK)
Main purposes: Deployment of instruments and 3D mapping of the whale “Saito”
Payload equipment:

1. Sediment trap (No.2)	1
2. Suction sampler & single canister	1
3. MBARI corer	2
4. Niskin bottle	2
5. Time-lapse video camera (NHK)	1
6. Rope cutter	2
7. SeaXerocks	1

Dive summary
Deploying the new devices for trapping the sediment and filming time-lapse video were conducted, and 3D mapping of the sea bottom was also made, besides observation and filming of the carcass and gathering animals.

Method:

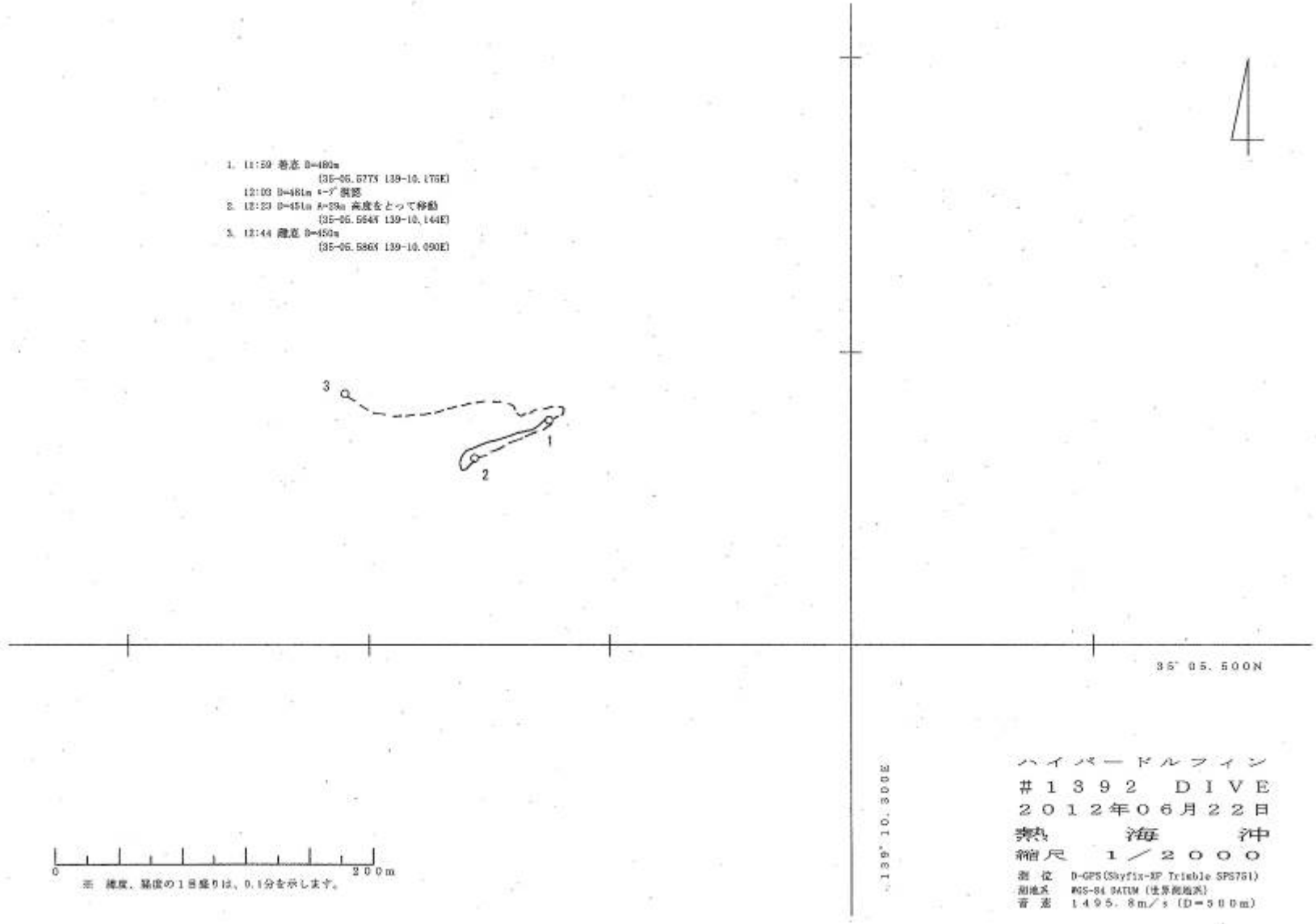
Another sediment trap was deployed approximately 50m away in the east where it collects falling down sediment such as marin snow, and the total accumlation volume will be evaluated, and it also tries to gather the juvenile individuals of Osedax. TimerCam, which had been retreived by 3rd dive, was re-deployed in the vicinity of the whale carcass. With its timer system, footages are to be filmed from 20:00 of June 23. to 15:00 of June 25. to capture the footages about animals dieting the carcass. Timelapse camera will be recovered by the coming Natsushima research dive in August.

Observation:

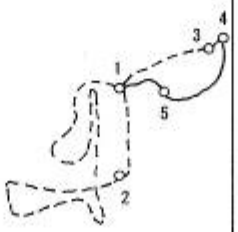
Mid-water observation was conducted at the depth of around 200m, however, macro living animals are scarcely observed besides copepods and occasional appearance of jelly fishes and lanternfish. Vehicle reached the sea bottom at the depth of 488 m. In the vicinity of sea bottom close to the whale carcass, we observed euphausid krills. Visibility seemed to have decreased down to 7m. Recent typhoon may be the cause of this visibility fall.

Dr. Adrian from University of Tokyo conducted 3D mapping observation for 2 hours. Mapping distances from sea bottom were varied as 8m, 7m, and so forth. We wrapped up #1395 observation with srurp-gun sampling of pagnose eels, and left the sea botom at 18:10.

3-3. Dive tracks



1. 16:32 D=487m 観音根頭
(35-05.572N 139-10.362E)
2. 17:24 D=488m 水中ビデオカメラ根頭
(35-05.548N 139-10.382E)
1. 17:35 D=485m 観音根頭
3. 17:41 D=488m ニスキン採水(赤・1本)
(35-05.583N 139-10.292E)
4. 17:44 着底 D=491m
(35-05.586N 139-10.297E)
17:47 MBARI根掘(青・1本)
5. 17:51 D=488m ANCP根頭
(35-05.571N 139-10.277E)
1. 17:57 D=489m ニスキン採水(緑・1本)
18:00 MBARI根掘(緑・1本)
18:08 スラープガンによる生物採集
18:12 離底 D=489m



35° 05. 500N

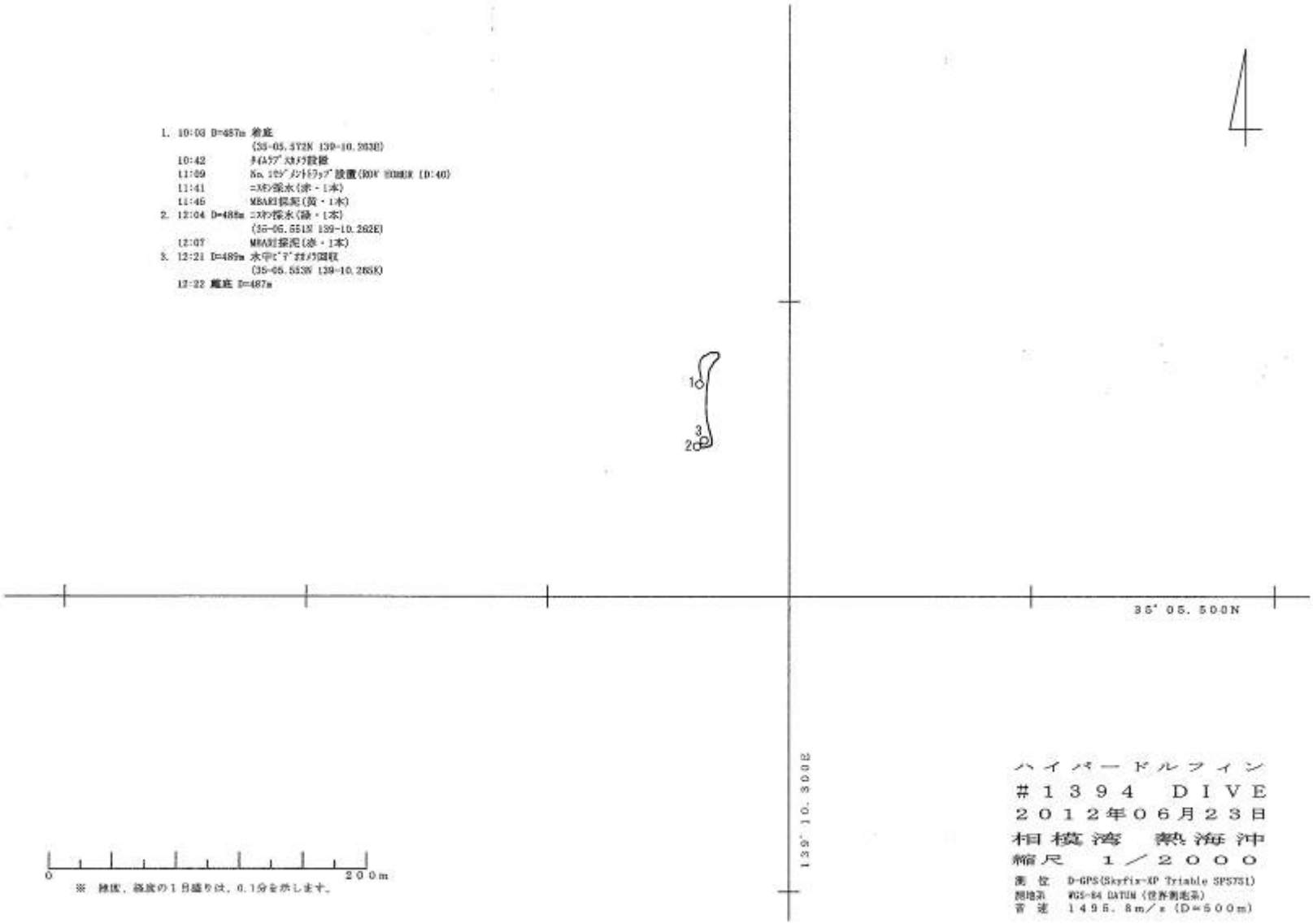
139° 10. 300E

0 200m

※ 緯度，経度の１目盛りは，0.1分を示します。

ハイパードルフィン
＃１３９３ ＤＩＶＥ
２０１２年０６月２２日
熱　海　沖
縮尺　１／２０００

測　位　D-GPS(Skyfix-XP Trimble SPS751)
測地系　WGS-84 DATUM (世界測地系)
音　速　１４９５．８ｍ／ｓ (Ｄ＝５００ｍ)



1. 10:03 D=487m 着底
(35-05.572N 139-10.293E)
10:42 ﾁｪｱﾗﾌﾞ ｶﾒﾗ設置
11:09 No.1ﾏｼﾞｯｸﾄﾗｯﾌﾟ 設置(ROV HYBOX (D:40)
11:41 ﾆｽﾝ採水(赤・1本)
11:45 MBA泥採泥(黄・1本)
2. 12:04 D=488m ﾆｽﾝ採水(緑・1本)
(35-05.551N 139-10.282E)
12:07 MBA泥採泥(赤・1本)
3. 12:21 D=489m 水中ﾋﾞﾃﾞｵｶﾒﾗ回収
(35-05.553N 139-10.285E)
12:22 **離底** D=487m

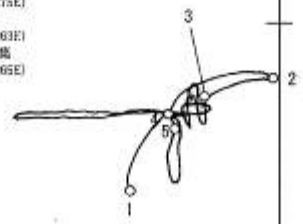
0 200m

※ 緯度，経度の１目盛りは，0.1分を示します。

ハイパードルフィン
＃１３９４　ＤＩＶＥ
２０１２年０６月２３日
相模湾　熱海沖
縮尺　１／２０００

測　位　D-GPS(SkyFix-XP Triable SPS751)
測地系　WGS-84 DATUM (世界測地系)
音　速　１４９６．８ｍ／ｓ (D＝５００ｍ)

1. 15:14 D=488m 着底
(35-05.554N 139-10.259E)
2. 16:04 D=491m No.2ｶﾒﾝﾄﾗｯﾌﾟ設置(SOF HOMEN ID:44)
(35-05.545N 139-10.269E)
3. 16:20 D=484m 3D画像ﾏｯﾋﾟﾝｸﾞ開始
(35-05.580N 139-10.275E)
4. 17:50 D=488m 水中ﾋﾞﾃﾞｵﾊﾞｲ設置
(35-05.575N 139-10.263E)
5. 17:58 D=489m ｽﾃｰﾌﾞﾝによる生物採集
(35-05.571N 139-10.265E)
18:01 離底 D=494m



35° 05. 500N

139° 10. 300E

0 200m

※ 緯度、経度の１目盛りは、0.1分を示します。

ハイパードルフィン
＃１３９５　ＤＩＶＥ
２０１２年０６月２３日
相模湾　熱海沖
縮尺　１／２０００

測　位　D-GPS(Skyfix-XP Trimble SPS751)
測地系　WGS-84 DATUM (重力測地系)
音　速　1495.8m／s (D＝500m)

4. 3D mapping

Two mapping devices were mounted on Hyper-Dolphin as shown in figure 1 in order to create high resolution digital 3D colour reconstructions of the whale carcass and the surrounding seafloor. One system, SeaXerocks 1, is aimed at recording images at low to medium altitudes (1.5m to 4.5m) at high frame rate. The second system, SeaXerocks 2, is aimed at recording stereo image pairs from middle to high altitudes of up to 8m, with the option of employing 4 synchronised flashes. The complete setup consists of one USB "Firefly" colour camera, two high sensitivity FireWire "ExiAqua" colour cameras, a sheet laser, two LED panels, 4 flashes, a DVL with depth sensor and two PCs.

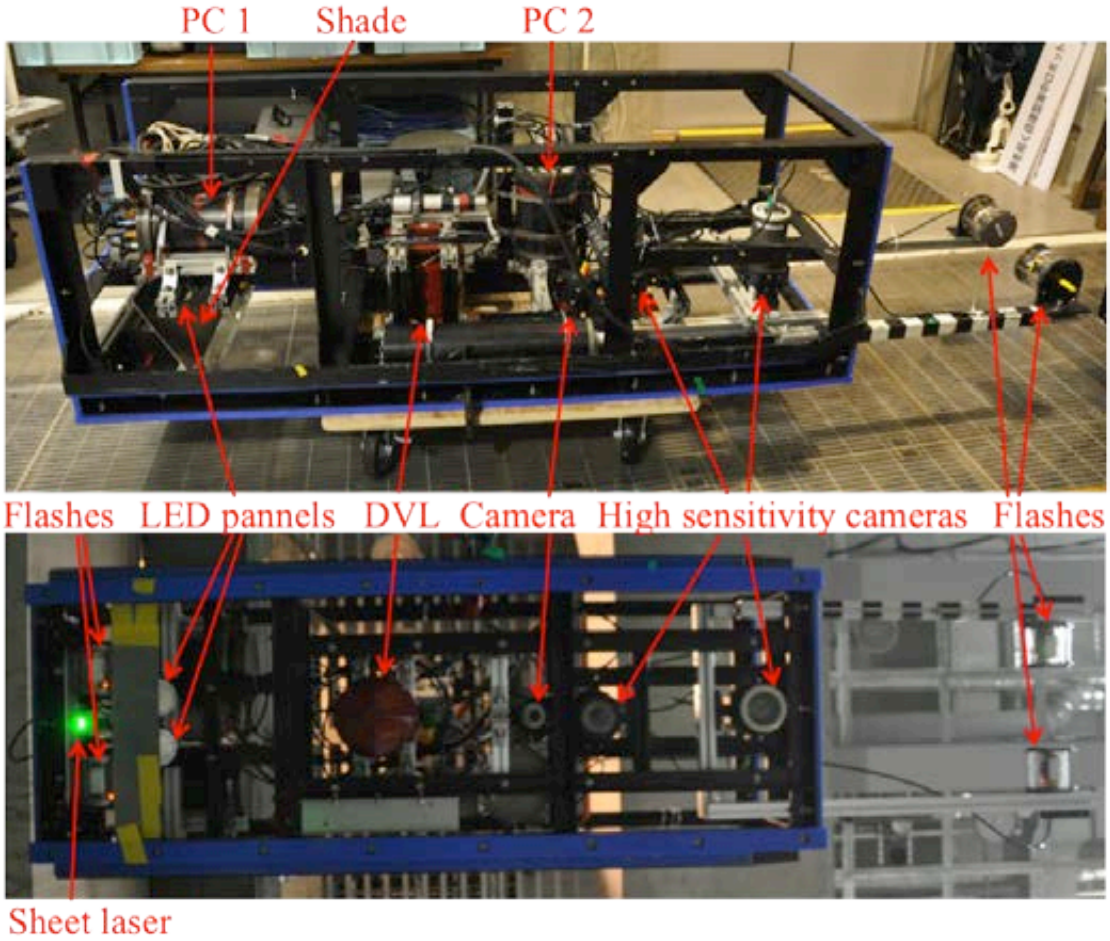


Fig. 1: Frame that was mounted on Hyper-Dolphin, carrying the mapping devices

For mapping from low to medium altitudes, the sheet laser projects a green laser line onto the seafloor perpendicular to the direction of motion of the vehicle while the LED panels illuminate the area behind and the cameras, mounted with an offset from the sheet laser as illustrated in figure 2, continuously record images, such as those shown in figure 3. As the vehicle moves forwards, the projected laser line scans the shape of seafloor, and through triangulation of the laser projections captured by each camera, it is possible to generate a detailed 3D bathymetry of the seafloor based on the vehicle's position. This system has been previously deployed using Hyper-Dolphin during NT10-11 and KY11-02 leg 2 for manganese crust surveys at Takuyo-Daigo seamount and Ryusei seamount. It has also been applied to survey active hydrothermal vents in Okinawa (NT11-17) and on the AUV Tuna-Sand of the University of Tokyo in Kagoshima Bay, see figure 4.

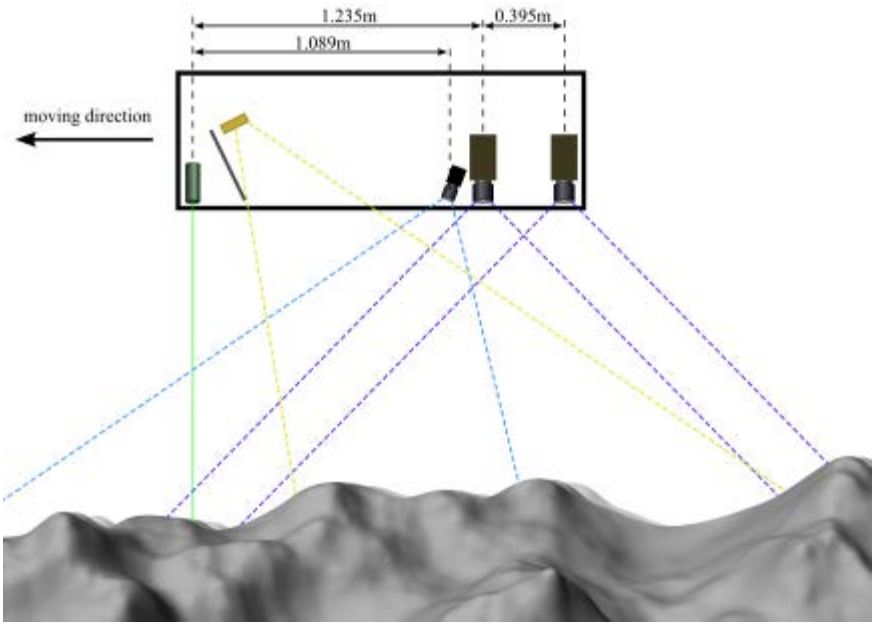


Fig. 2 Sheet laser and camera setup used during NT12-15

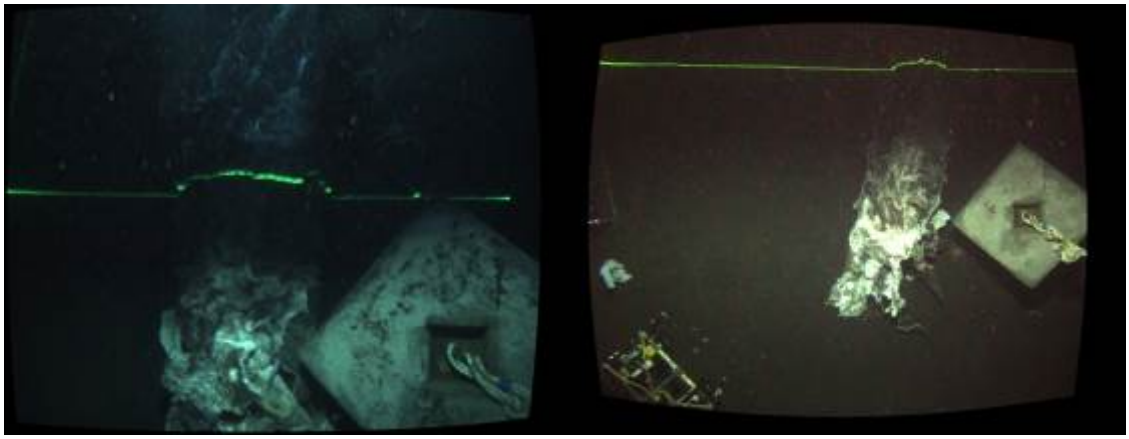


Fig. 3 Images showing the laser line projection and the area behind illuminated by the LED panels. The image to the left was taken from an altitude of 2.5m by the Firefly camera, the image to the right from an altitude of 4.5m by an ExiAqua camera. Even though the distance to the object is almost double in the image to the right, the image quality is significantly better due to the ExiAqua camera's high sensitivity

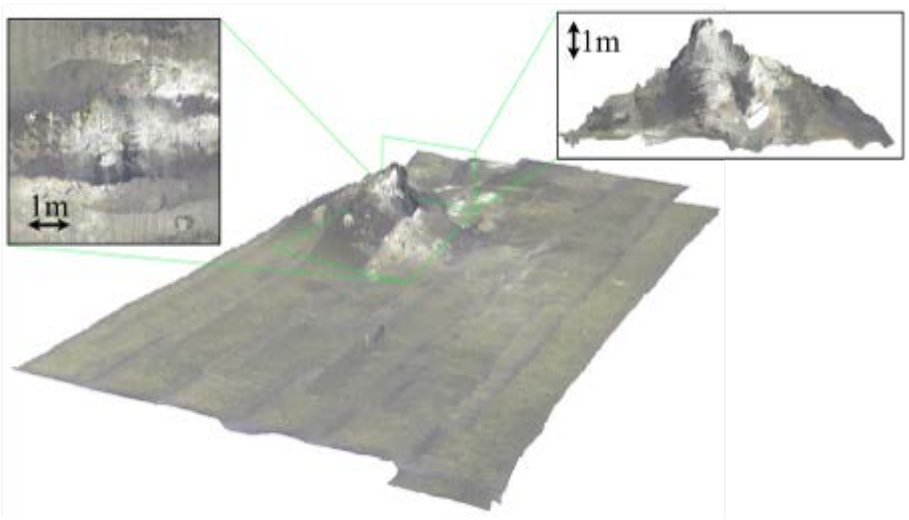


Fig. 4 3D reconstruction of White Cone Chimney at Kagoshima Bay. The data was obtained using SeaXerocks 1 mounted on the AUV Tuna-Sand in 2010 [1]

For long range mapping the sheet laser and the LEDs are turned off. All four flashes are triggered simultaneously at an interval of 6s and images are recorded by both high sensitivity cameras at the same time. Even though the water was a bit turbid, images could successfully be recorded from altitudes of up to 8m. The high altitude and use of a wide-angle lens made it possible to cover an area of up to 7m×9m with a single photo. Figure 5 shows a photo of the whole whale carcass taken from high altitude.

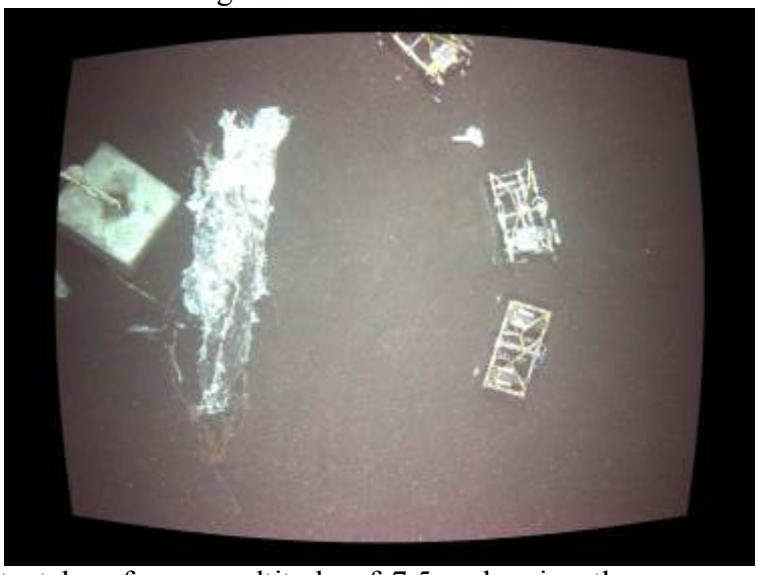


Fig. 5 Flash photo taken from an altitude of 7.5m showing the carcass of the whale, the concrete block to the left and 3 time lapse camera frames to the right.

Results

Using our mapping method, described more detailed in [1], we generated 3D reconstructions with data acquired from different altitudes and with Hyper-Dolphin moving at different speeds. Figure 6 is a 3D reconstruction generated from images acquired 2.5m over the seafloor by the Firefly camera. Figure 7 and 8 show two views of a 3D reconstruction generated from images recorded from an altitude of 4.5m by the Firefly cameras while Hyper-Dolphin moved at only 10cm/s (0.2knot). Therefore the 3D map has a very high resolution in forward direction, and due to the relatively high altitude, it also covers a wide swath. While the images for that dataset were recorded by the Firefly camera, images were also recorded by the ExiAqua cameras and then used to generate the 3D reconstruction shown in figure 9. Due to the high sensitivity of the camera, the images and therefore also the 3D reconstruction are brighter than those recorded by the Firefly cameras, even if lighting was very limited. However, as images could only be recorded at 1 fps, the 3D reconstruction is coarse.

We are currently still working on the data and the results shown here are only preliminary results. We are planning to combine the high resolution of the bathymetry map obtained from the Firefly camera images with the high quality colour images recorded by the ExiAqua cameras in order to produce 3D reconstructions that have high resolution and colour accuracy at the same time.

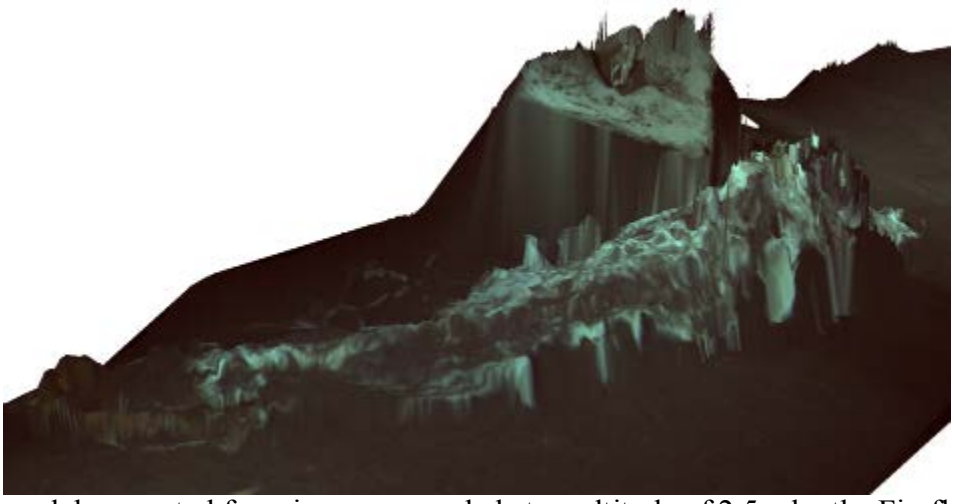


Fig. 6 3D model generated from images recorded at an altitude of 2.5m by the Firefly camera

Fig. 7 Top view of a 3D model generated from images recorded at an altitude of 4.5m by the Firefly camera

Fig. 8 3D model generated from images recorded at an altitude of 4.5m by the Firefly camera

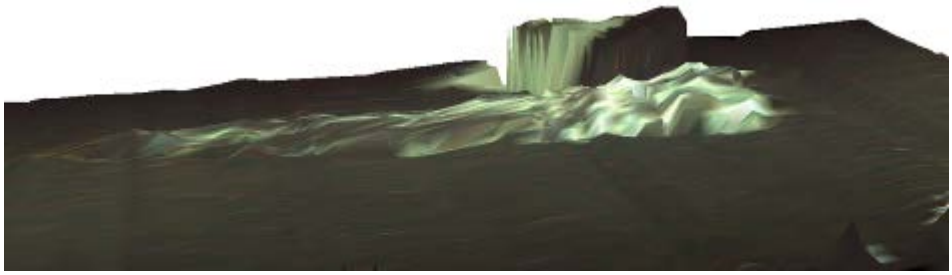
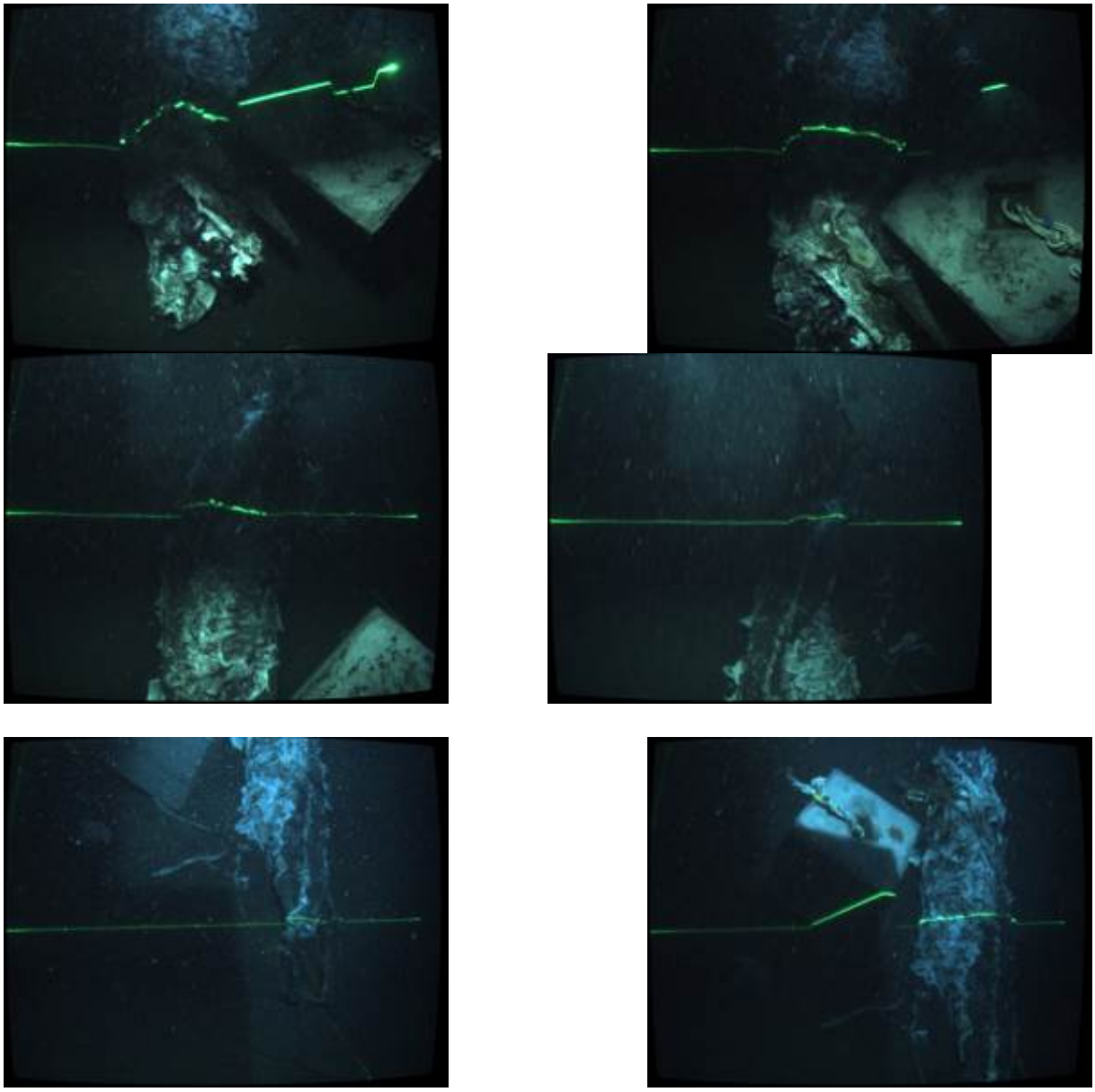


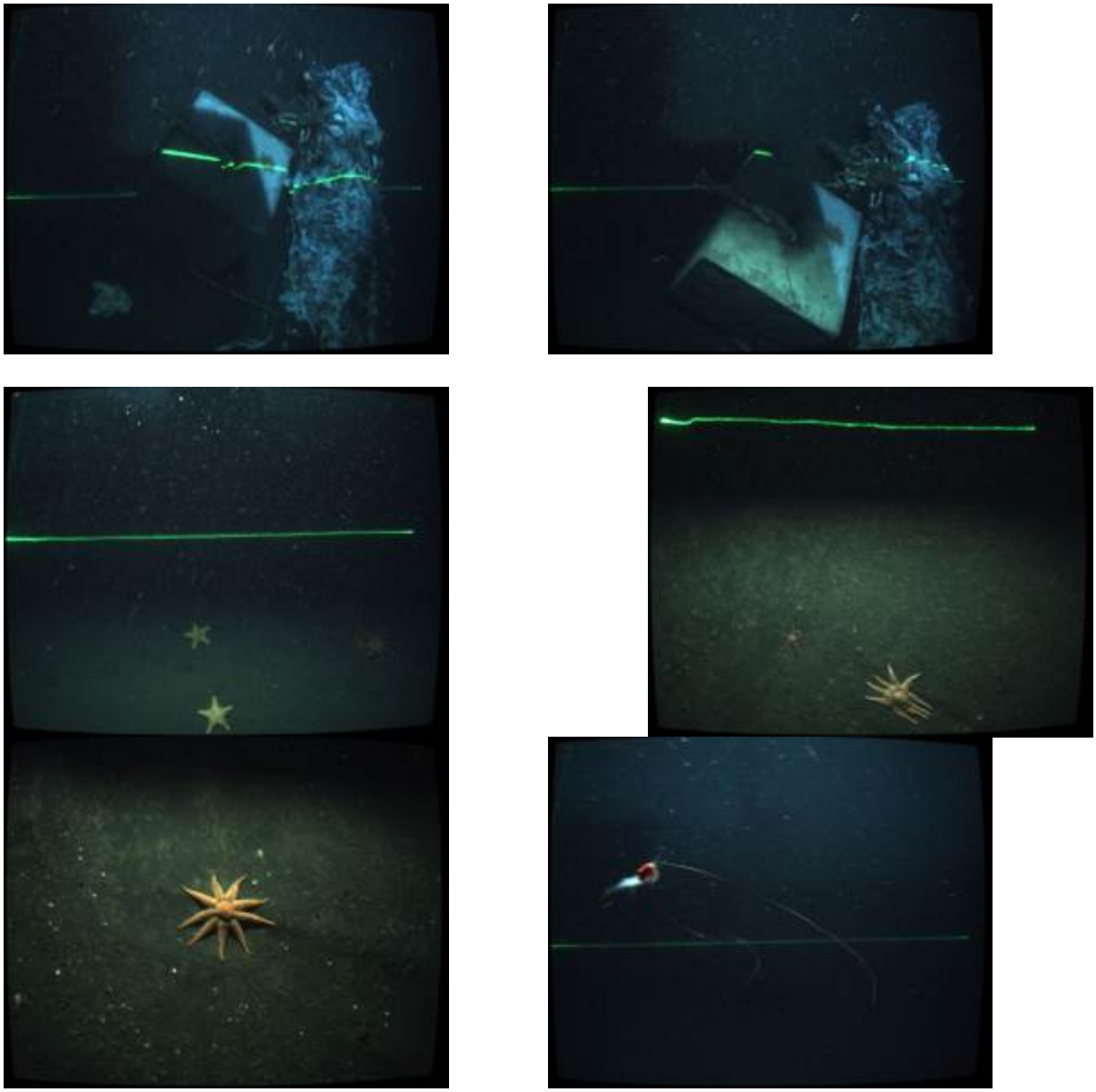
Fig. 9 3D model generated from images recorded at an altitude of 4.5m by an ExiAqua camera

References

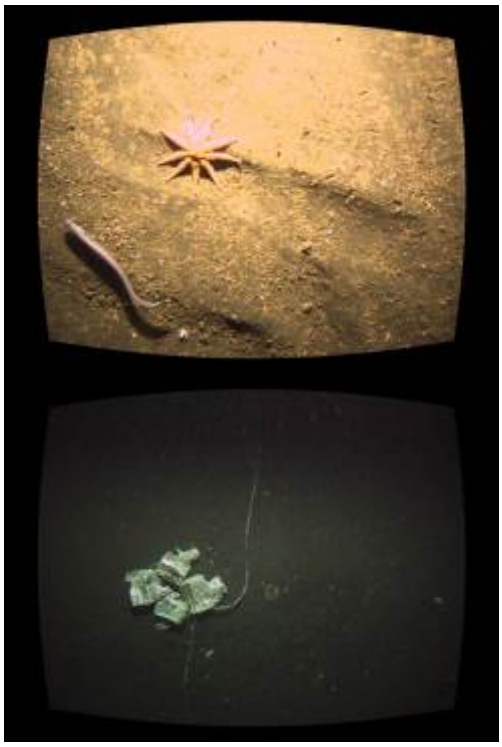
[1] Adrian Bodenmann, Blair Thornton, Takeshi Nakatani, Tamaki Ura, '3D colour reconstructions of a hydrothermally active area using an underwater robot', In Proc. IEEE/MTS Oceans'11 Kona, 110422-033, 2011.

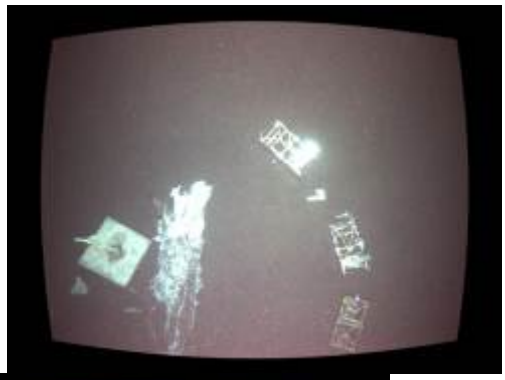
Selection of images taken by "Firefly" camera

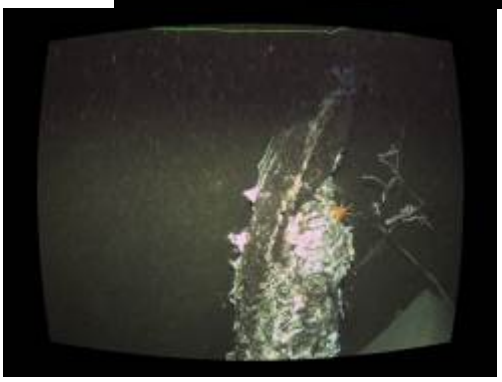


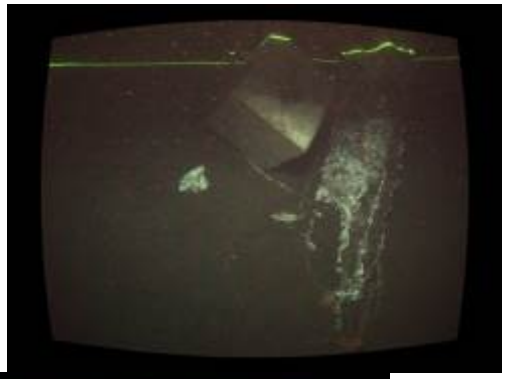


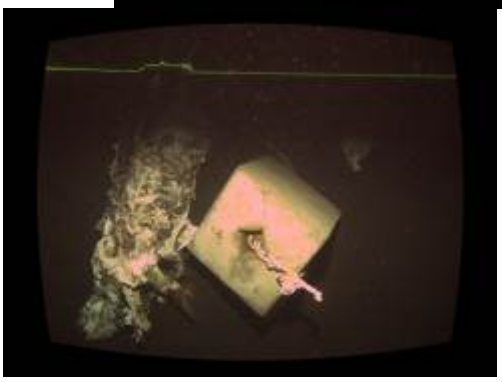
Selection of images taken by “ExiAqua“ high sensitivity camera











5. Sediment trap operation

No.1 sediment trap was deployed beside the whale carcass during the Hyper-Dolphin dive #1394 at a depth of 487 m (35-05.572‘N, 139-10.263‘E). No.2 sediment trap was deployed 50 m west from the whale carcass during the Hyper-Dolphin dive #1395 at a depth of 491 m (35-05.585‘N, 139-10.298‘E).

6. Time-lapse filming of a whale and whale vertebrae

NHK's TimerCam system

NHK team brought in a deep water pressure proof timelapse video camera system, named 'TimerCam'. Camera and lighting system of TimerCam are identical with JAMSTEC's timelapse video camera system developed by Goto Aquatics Inc.
NHK's Deep Sea Project team has utilized TimerCam in Suruga Bay for almost 3 years, and found the system most reliable and easy to use. TimerCam has filmed many precious footages in the various circumstances. NHK team regards it as the most useful camera among the deep sea cameras they have utilized.

（TimerCam ）

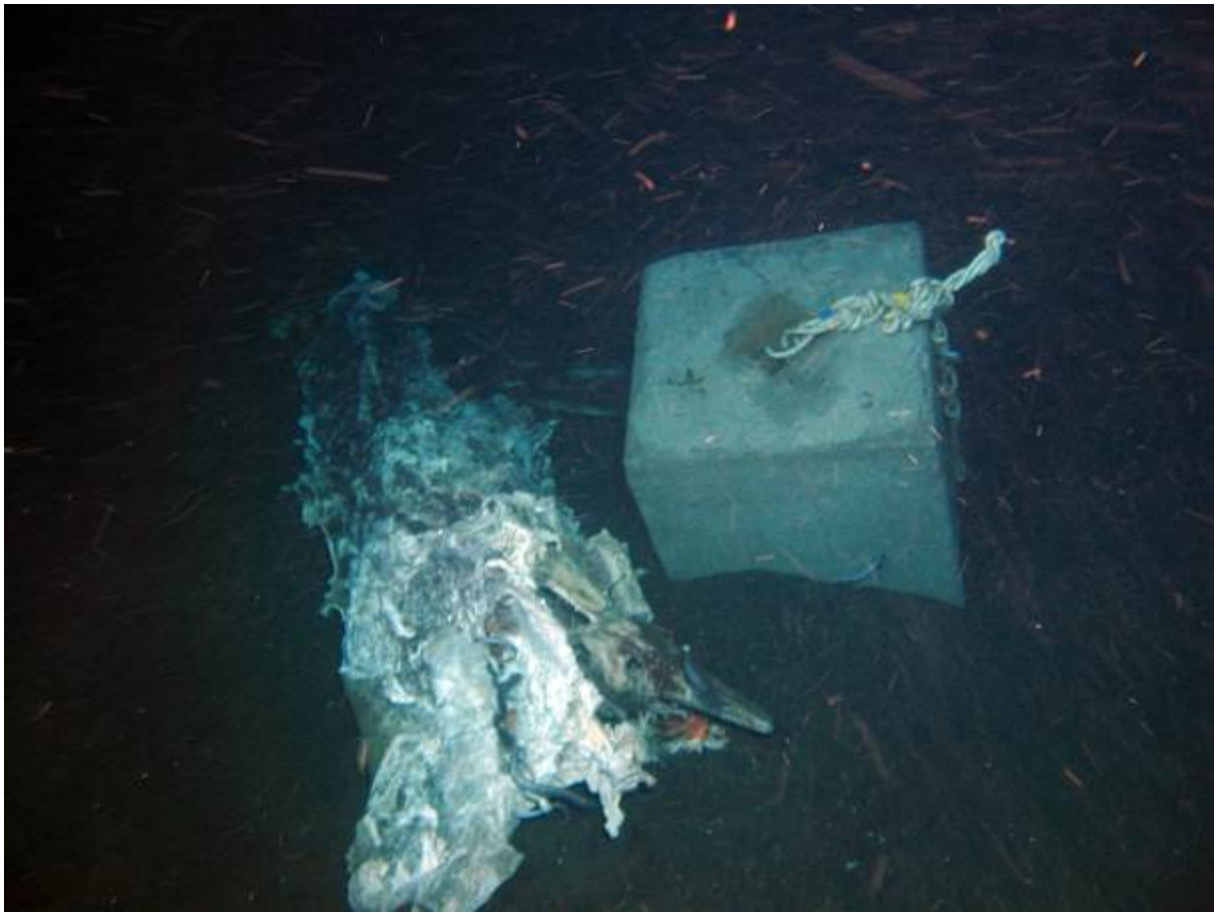
TimerCam weighs about 20 kg for the camera system, and weighs 40kg with stainless frame to deploy on the sea bottom. Camera system of TimerCam consists of Sony Handycam HC-3 with fisheye wide conversion lenz. Owing to this fisheye lenz and doom port, TimerCam is capable of commanding very wide view. Video is recorded on HDV mini cassette which enables to record full-HD footages up to 85 min. depending on the tape length.

TimerCam is equipped with two white LED light sets, left and right, and the battery for the lights are contained in the housing. Timer for shooting the video can be set with 4 index, pre-record stand-by duration(STB), each recording duration (REC), each recording interval (INT), and times to repeat the recording and interval.(setting timer)
When filming mid-water, the system is hung with rope or fishing line, and for filming benthic circumstances, the stainless frame is applied to adjust the shooting hight.

7. Scientific results
7-1. Comprehensive results

Yoshihiro FUJIWARA
(JAMSTEC)

To elucidate faunal succession and decomposition process of a whale carcass, an ROV diving research was conducted in Sagami Bay. A baby sperm whale (5 m in total length) was submerged at a depth of 500 m in the bay on June 8, 2012. More than 40% of the soft tissues were consumed within 2 weeks from the deployment. Most dominant consumers were eels and crustaceans from the ROV observations. For long-term observations and analyses, two time-lapse cameras and two sediment traps were deployed around the carcass. Additionally, 3D mapping around the whale was conducted.



A submerged sperm whale carcass at a depth of 500 m in Sagami Bay. More than 40% of the soft tissues were consumed within 2 weeks from the deployment.

7-2. Respective results

Masayuki MIYAZAKI
(JAMSTEC)

Microbial diverse and taxonomic studies at whale-fall community

Sediment sample were collected by MBARI core sampler and sterilized sediment sampler from the dive HPD#1393 “Baby makko” whale, the dive HPD#1394 “Baby makko” whale, and “Vertebra of BerardiusI” site. Four sediment samples in total were collected. We researched a succession of the microorganism from the “Baby makko” whale and “Vertebra of BerardiusI” site in Sagami Bay. In addition, we try to cultivate anaerobic bacteria of specific whale fall site.

HPD#1393 Baby Makko site off Atami

Control (20 m from the baby Makko)
Depth 488 m, length 16 cm

Closely to the head of Baby Makko
Depth 488 m, length 12 cm

HPD#1394 Baby Makko site off Atami

Closely to the head of Baby Makko
Depth 487 m, length 12 cm

Closely to the vertebra site
Depth 488 m, length 24 cm

Yuji ONISHI
(Okayama University)

In this cruise, I collected sediment, sea water and animal samples at Sagami Bay and off Atami by the ROV “Hyperdorphin”. Sediment samples were squeezed pore water. And I froze sediment and animal samples. I percolated sea water samples and measured concentration of ammonia and silica in sea water and pore water on board.

7-3. Illustrations

8. Proposals for the future studies

Yoshihiro FUJIWARA
(JAMSTEC)

1) Early succession of a whale-fall ecosystem in Sagami Bay
Fujiwara, Kawato, Miyazaki, et al.

2) Molecular phylogenetic analyses of Osedax species
Fujiwara, Kawato, Miyamoto, et al.

3) Molecular phylogeny of Osedax symbionts and cultivation
Miyazaki, Fujiwara, Kawato et al.

Masayuki MIYAZAKI
(JAMSTEC)

1) Phylogenetic analysis of microorganism in whale-fall community.
Masayuki Miyazaki, Masaru Kawato and Yoshihiro Fujiwara. (JAMSTEC)

2) Taxonomic study of anaerobic and aerobic microorganism in the whale fall site.
Masayuki Miyazaki, Taishi Tubouchi, Masaru Kawato and Yoshihiro Fujiwara. (JAMSTEC)

Yuji ONISHI
(Okayama University)

I will compare the analytical results among each animal species from whale bones in order to estimate how they are supported by whale bones.

Masaru KAWATO
(JAMSTEC)

1. Phylogenetic analysis of the early colonized *Osedax* polychaetes and their symbiont bacteria from the newly deployed whale falls off Atami, Sagami bay.

2. Symbiosis in the deep-sea mussels attached on the whale bone from Sagami bay.

Notice on using

This cruise report is a preliminary documentation as of the end of the cruise.This report may not be corrected even if changes on contents (i.e. taxonomic classifications) may be found after its publication. This report may also be changed without notice. Data on this cruise report may be raw or unprocessed. If you are going to use or refer to the data written on this report, please ask the Chief Scientist for latest information. Users of data or results on this cruise report are requested to submit their results to the Data Management Group of JAMSTEC.

Appendix
I. Sample list
I-1. Macro organisms

HPD#1393

On board ID	Sample Name (English) / Scientific Name	Number of Individuals (Amount)	Fixation	Preservation	Latitude			Longitude			Depth	Date Collected			Remarks
					Deg.	Min.	N/S	Deg.	Min.	E/W	[m]	YYYY	MM	DD	
HPD#1393-01	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-02	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-03	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-04	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-05	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-06	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-07	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-08	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-09	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-10	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	muscle tissue
HPD#1393-B01	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B02	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B03	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B04	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B05	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B06	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B07	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B08	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-B09	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood

HPD#1393-B10	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	blood
HPD#1393-W01	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	25 cm
HPD#1393-W02	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	29.3 cm
HPD#1393-W03	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	30.3 cm
HPD#1393-W04	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	26.8 cm
HPD#1393-W05	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	20.0 cm
HPD#1393-W06	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	18.6 cm
HPD#1393-W07	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	20.0 cm
HPD#1393-W08	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	20.2 cm
HPD#1393-W09	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	20.3 cm
HPD#1393-W10	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	20.6 cm
HPD#1393-11	Physeter macrocephalus	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	tissue
HPD#1393-12	Ophiuroid	1	Frozen	Frozen	35	05.586	N	139	10.297	E	491	2012	6	22	MBARI Blue
HPD#1393-13	Ophiuroid	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	MBARI Green
HPD#1393-31	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	20.2 cm
HPD#1393-32	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	17.2 cm
HPD#1393-33	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	14.1 cm
HPD#1393-34	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	16.2 cm
HPD#1393-35	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	12.6 cm
HPD#1393-36	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	20.6 cm
HPD#1393-37	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	15.1 cm
HPD#1393-38	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	15.1 cm
HPD#1393-39	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	13.0 cm
HPD#1393-40	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	15.4 cm
HPD#1393-41	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.277	E	488	2012	6	22	14.8 cm

HPD#1394

On board ID	Sample Name (English) / Scientific Name	Number of Individuals (Amount)	Fixation	Preservation	Latitude			Longitude			Depth	Date Collected			Remarks
					Deg.	Min.	N/S	Deg.	Min.	E/W	[m]	YYYY	MM	DD	
HPD#1394-01	Sipunculid	1	Frozen	Frozen	35	05.572	N	139	10.263	E	487	2012	6	23	MBARI Yellow

HPD#1395

On board ID	Sample Name (English) / Scientific Name	Number of Individuals (Amount)	Fixation	Preservation	Latitude			Longitude			Depth	Date Collected			Remarks
					Deg.	Min.	N/S	Deg.	Min.	E/W	[m]	YYYY	MM	DD	
HPD#1395-01	Physeter macrocephalus	1	Frozen	Frozen	35	05.571	N	139	10.265	E	489	2012	6	23	tissue
HPD#1395-02	Simenchelys parasitica	1	Frozen	Frozen	35	05.571	N	139	10.265	E	489	2012	6	23	16.9 cm
HPD#1395-03	Simenchelys parasitica	1	10% FA	10% FA	35	05.571	N	139	10.265	E	489	2012	6	23	15.5 cm
HPD#1395-04	Simenchelys parasitica	1	10% FA	10% FA	35	05.571	N	139	10.265	E	489	2012	6	23	12.0 cm
HPD#1395-05	Simenchelys parasitica	1	10% FA	10% FA	35	05.571	N	139	10.265	E	489	2012	6	23	（写真）

I-2. Sediments

investigator	purpose	storage	photo	additional description	Present Location
Miyazaki, Ohnishi	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Control (20 m from the baby Makko)	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Ohnishi	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Control (20 m from the baby Makko)	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Ohnishi	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Control (20 m from the baby Makko)	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Ohnishi	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the head of Baby Makko	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Ohnishi	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the head of Baby Makko	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Miyamoto	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the head of Baby Makko	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Miyamoto	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the head of Baby Makko	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Miyamoto	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the vertebra site	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Miyamoto	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the vertebra site	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Miyamoto	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the vertebra site	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)
Miyazaki, Miyamoto	Microbial study and Chemical study	Kept at 4ºC, -80ºC and LN2	+	Closely to the vertebra site	Miyazaki (JAMSTEC), Tsubouchi (JAMSTEC), Ohnishi (Okayama Univ.)

I-3. Water (Ohnishi)

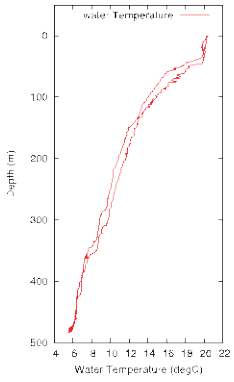
Dive	Sample ID	Color id	Water #	Gear	Date					Chemical analysis(30 ml)	Filtered for suspended matter
					YY	MM	DD	Time	Time zone		
#1393	HPD#1393 WR	Red	Niskin	HPD	2012	8	22	17:41	JST	O	O
#1393	HPD#1393 WG	Green	Niskin	HPD	2012	8	22	17:57	JST	O	O
#1394	HPD#1394 WR	Red	Niskin	HPD	2012	8	23	11:41	JST	O	O
#1394	HPD#1394 WG	Green	Niskin	HPD	2012	8	23	12:04	JST	O	O

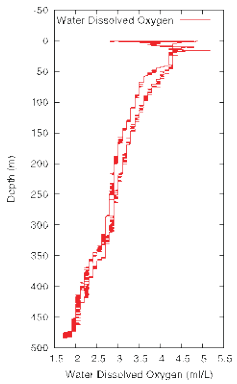
Dive	Sample ID	Latitude			Longitude			Depth (m)	Site	Present location
		Deg.	Min.	N/S	Deg.	Min.	E/W			
#1393	HPD#1393 WR	35	05.583	N	139	10.[illegible]	E	488	Off Atami, Sagami Bay	Yamanaka (Okayama Univ.)
#1393	HPD#1393 WG	35	05.571	N	139	10.[illegible]	E	489	Off Atami, Sagami Bay	Yamanaka (Okayama Univ.)
#1394	HPD#1394 WR	35	04.577	N	139	10.763	E	487	Off Atami, Sagami Bay	Yamanaka (Okayama Univ.)
#1394	HPD#1394 WG	35	04.551	N	139	10.762	E	488	Off Atami, Sagami Bay	Yamanaka (Okayama Univ.)

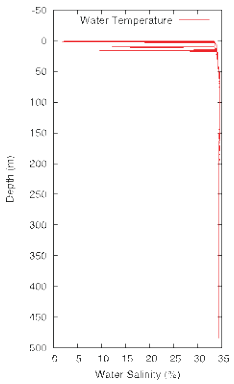
II. CTD/DO data

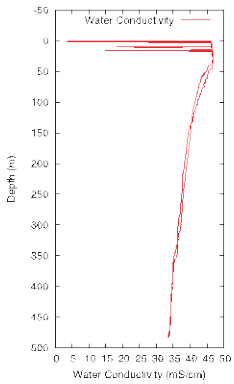
NT12-15, HPD #1392, 2012/06/22

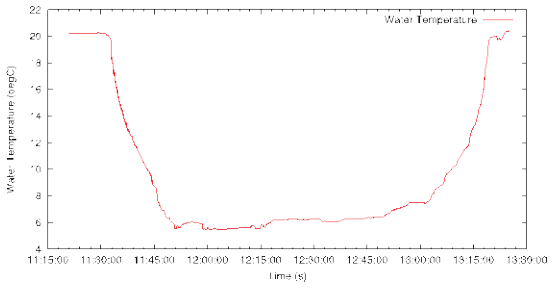
Baby Makko site off Atami

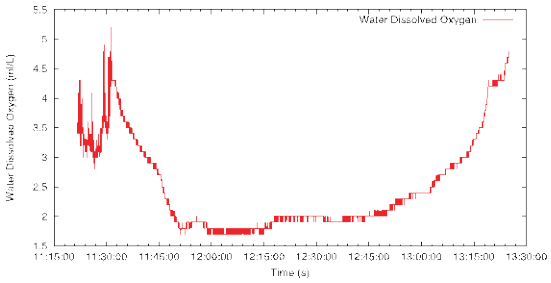


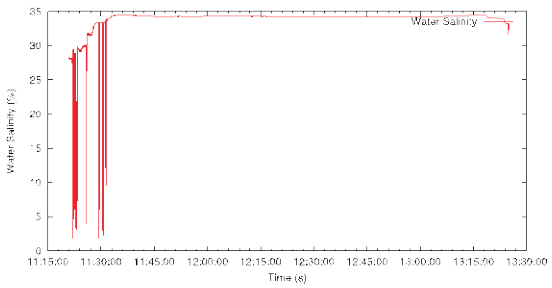


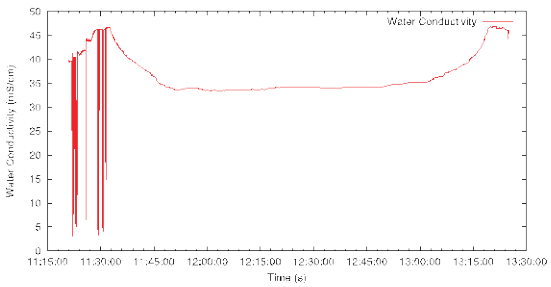






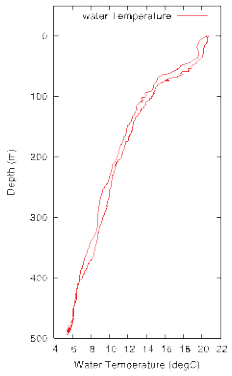


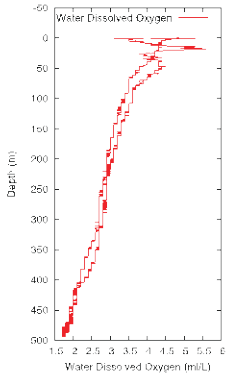


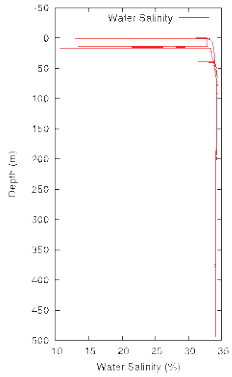


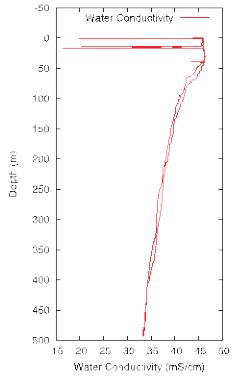
NT12-15, HPD #1393, 2012/06/22

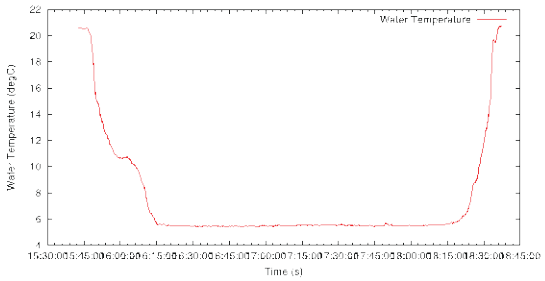
Baby Makko site off Atami

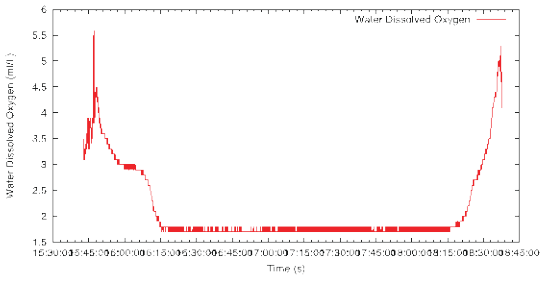


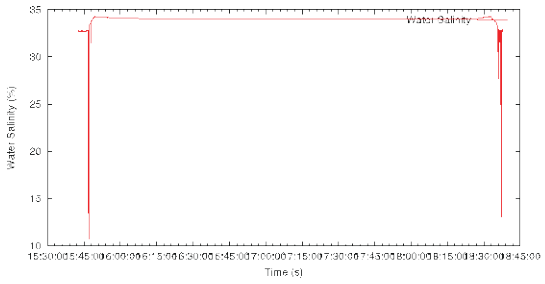


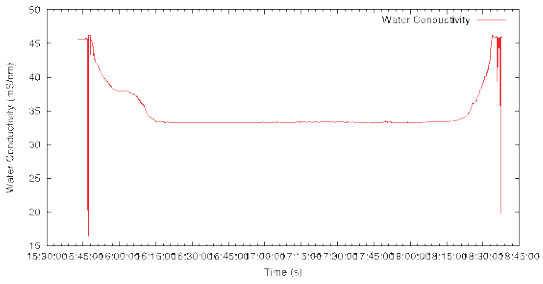






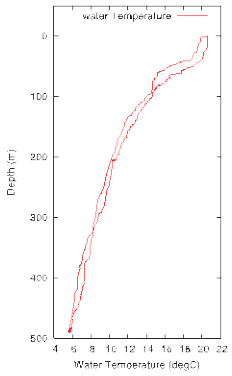


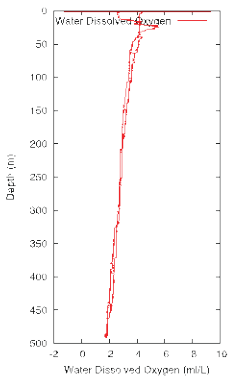


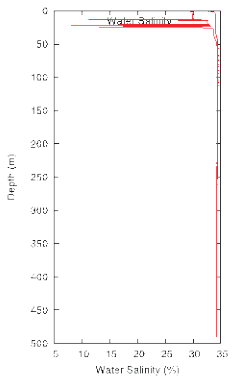


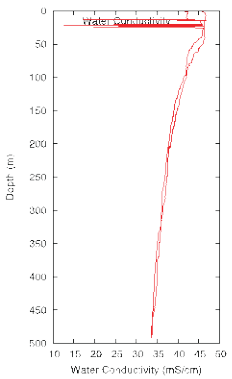
NT12-15, HPD #1394, 2012/06/23

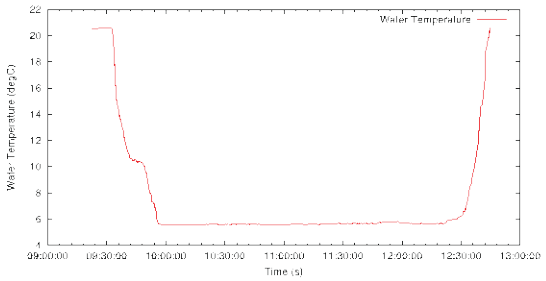
Baby Makko site off Atami

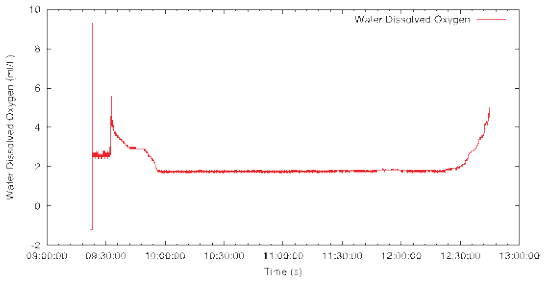


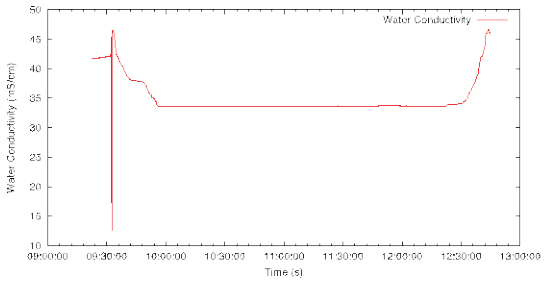


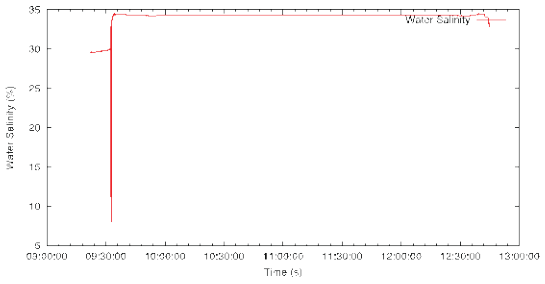






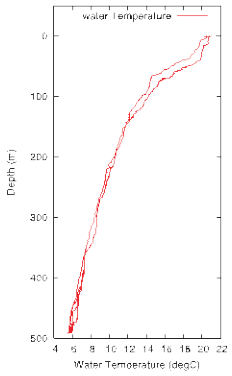


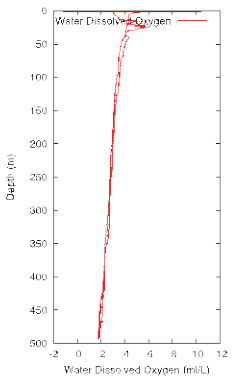


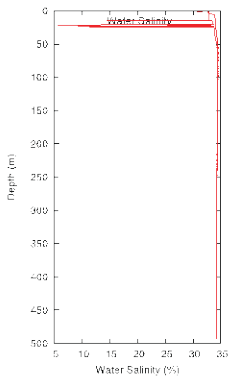


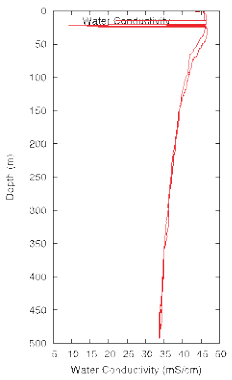
NT12-15, HPD #1395, 2012/06/23

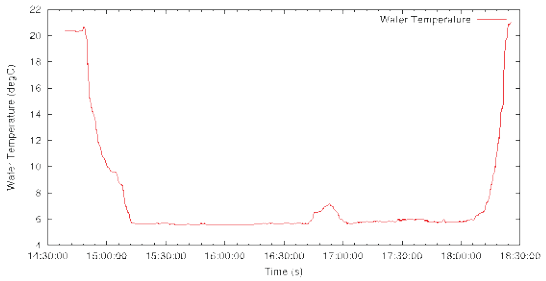
Baby Makko site off Atami

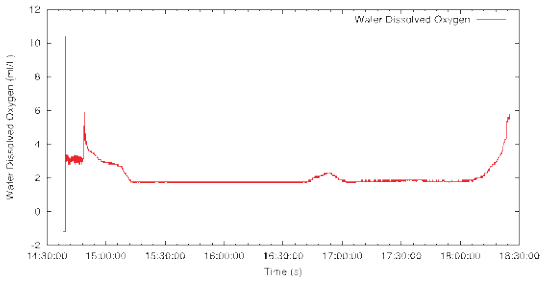


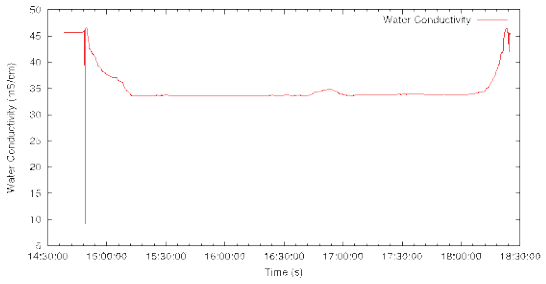


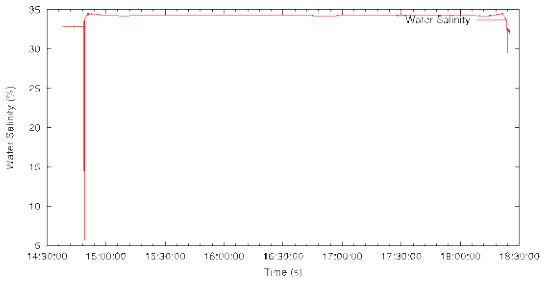






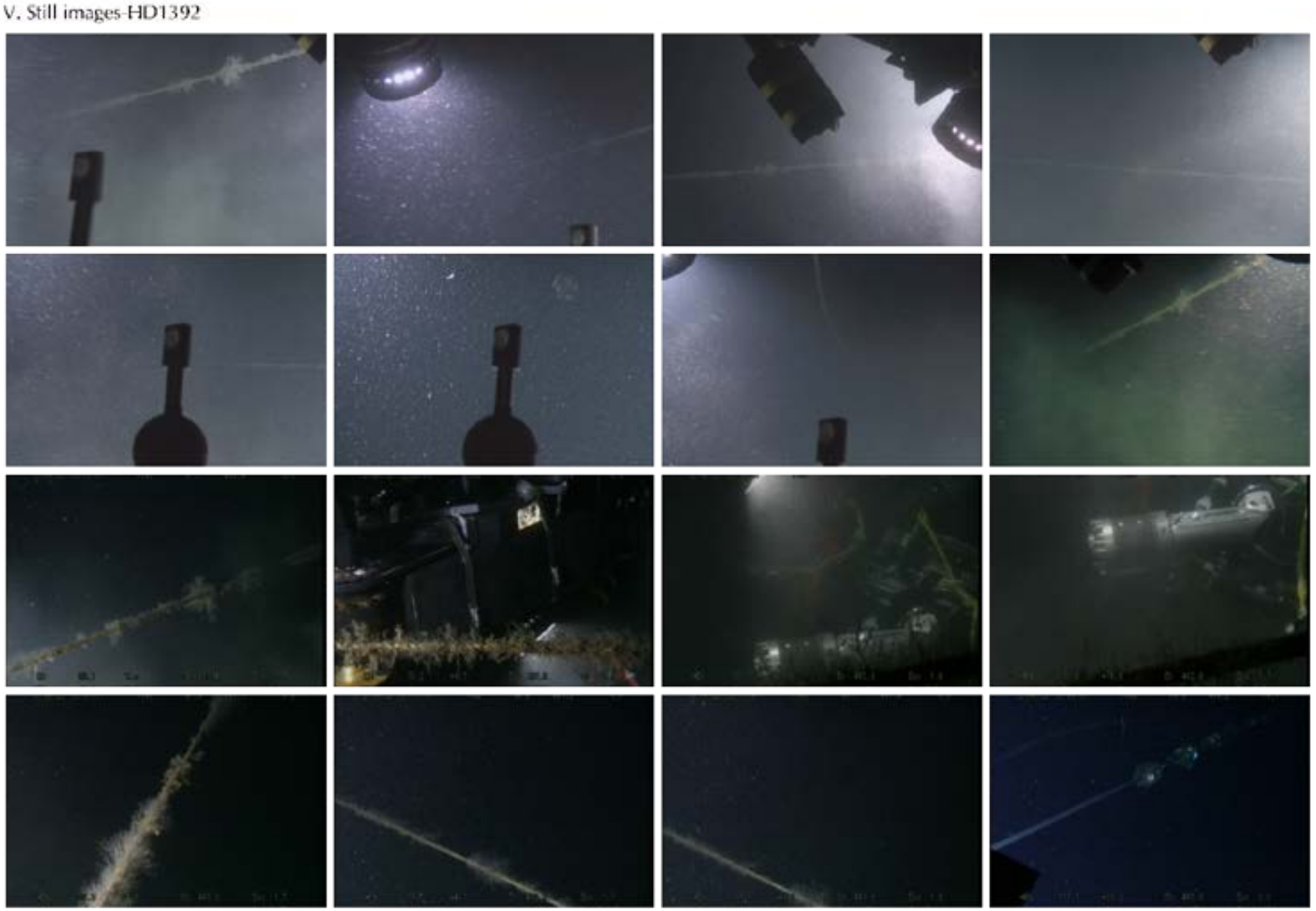




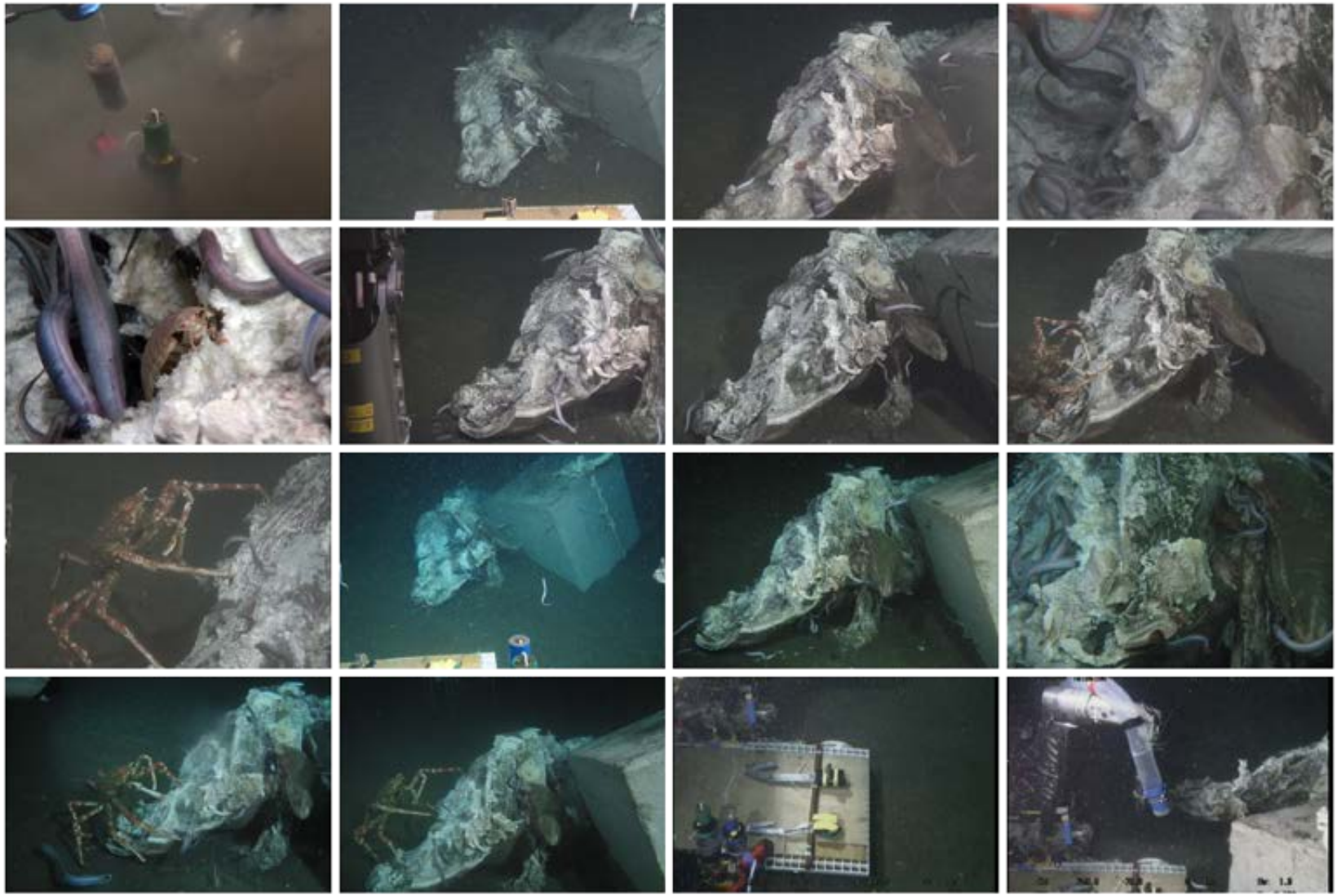


IV. XBT profiles

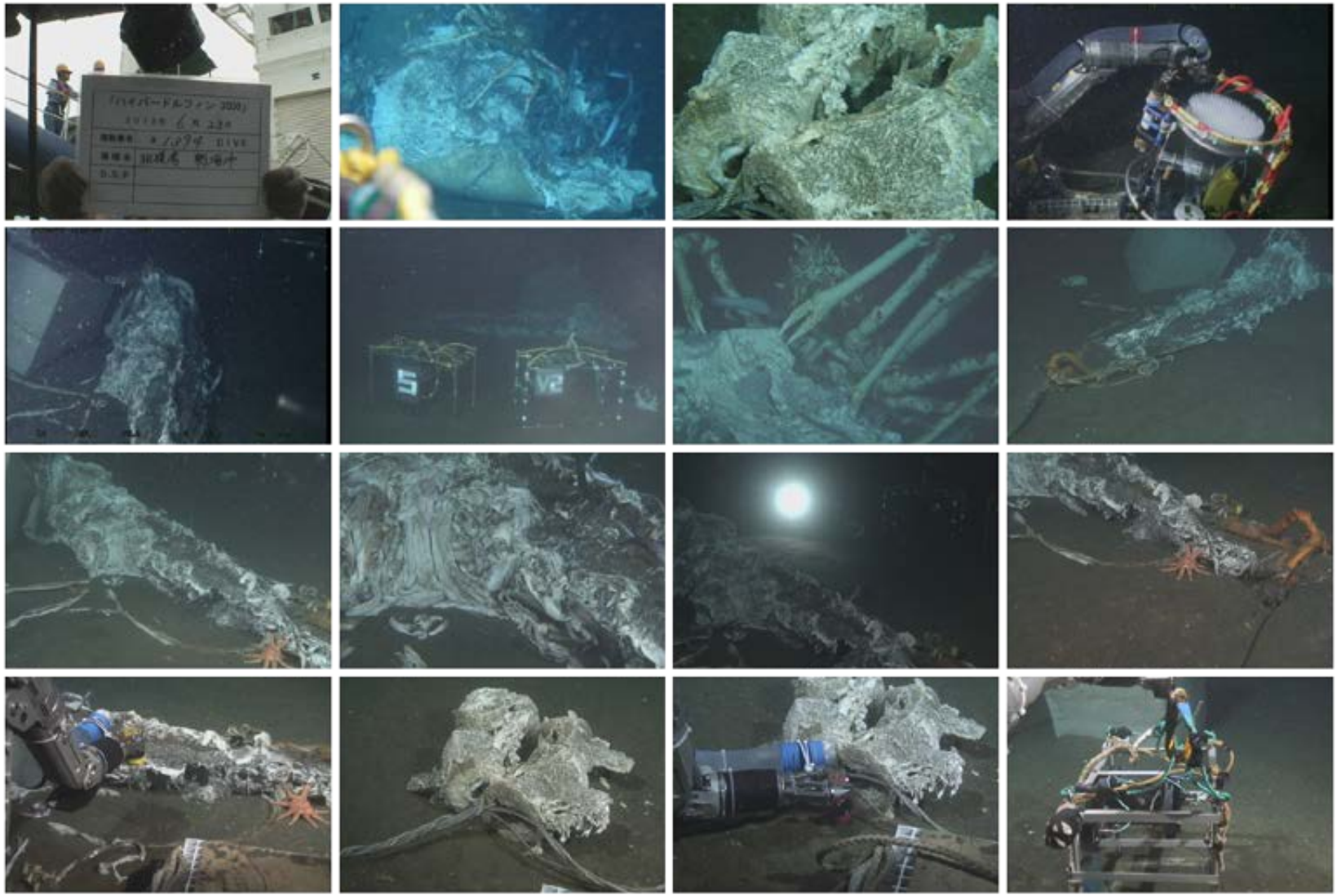
V. Still images from each dive (chief observers)



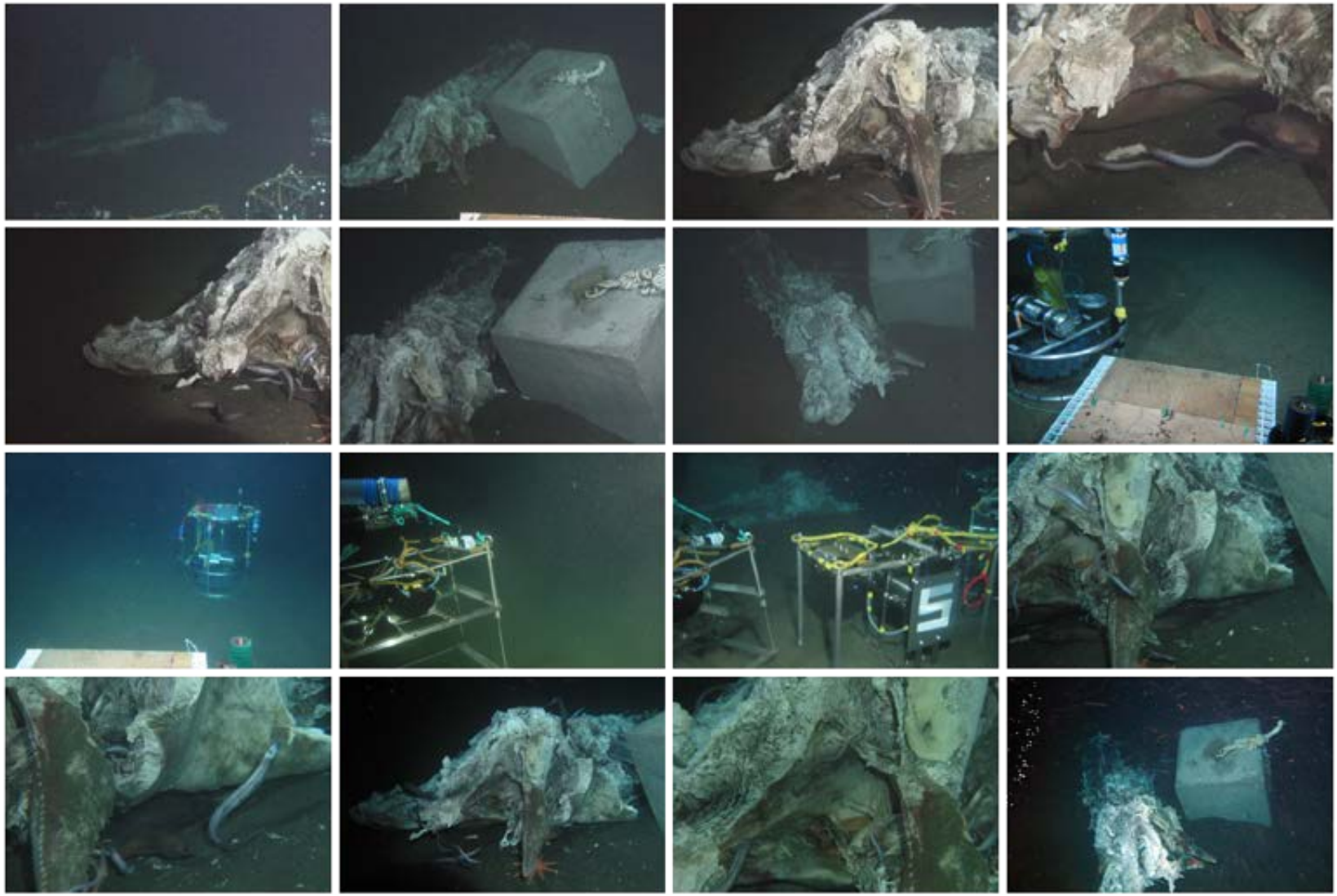
V. Still images-HD1393



V. Still images-HD1394



V. Still images-HD1395

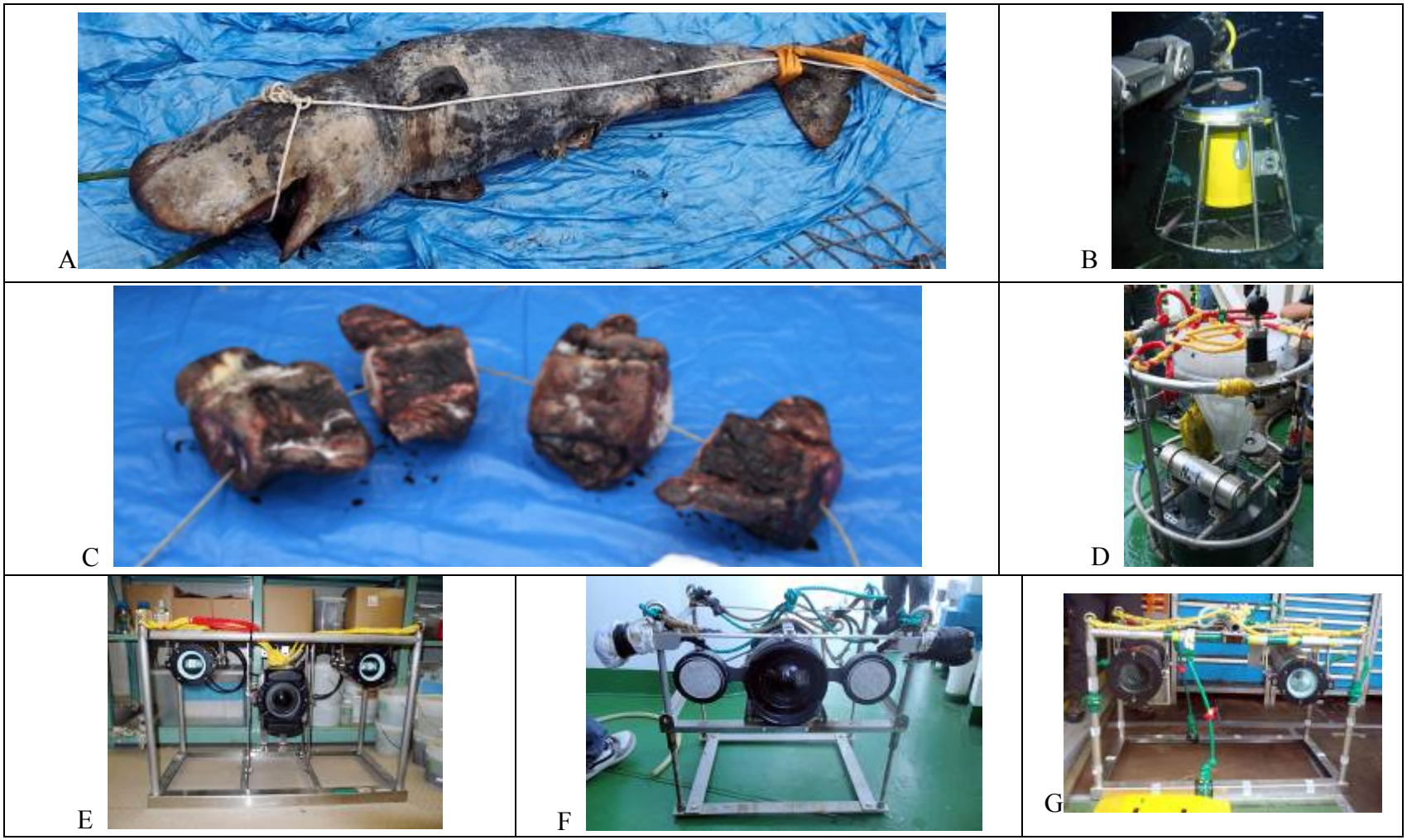


VI. Shipboard log

日付 Date	時間 Local Time	内容 Note	特記事項 Description	本船位置／気象／海象 Position/Weather/Wind/Sea condition
21-Jun-12		Sail out, proceeding to research area		
	14:00	boarded		
	15:00	let go all shore line, left YOKOSUKA		
	15:10-15:15	scientific meeting		
	16:00-16:30	carried out onboard education & training for scientis t s		
	18:05-19:30	scientific meeting		
	19:30	commenced drifting at off Atami		
22-Jun-12		ROV Hyper Dolphin dive 1392 and 1393		06/22 12:00 (UTC+9h)
	06:00	arrived at research area		35-05.7N,139-10.2E
	06:23-06:32	carried out MBES mapping servey		Off Atami
	06:39	released XBT at 35-05.5042N, 139-11.2147E		Rrain
	11:11	hoisted up HPD		NE-5 (Fresh breeze)
	11:16	launched HPD		3 (Sea slight)
	11:30	started HPD#1392 dive operation	Sagami Bay	3 (Moderate short)
	11:59	landed at sea bottom	Depth: 480m	Visibly: 2'
	12:44	left bottom	Depth: 450m	
	13:24	refloated HPD		
	13:38	recovered		
	15:29	hoisted up HPD		
	15:33	launched HPD		
	15:46	started HPD#1393 dive operation	Sagami Bay	
	17:44	landed at sea bottom	Depth: 491m	
	18:12	left bottom	Depth: 489m	
	18:35	refloated HPD		
	18:50	recovered		

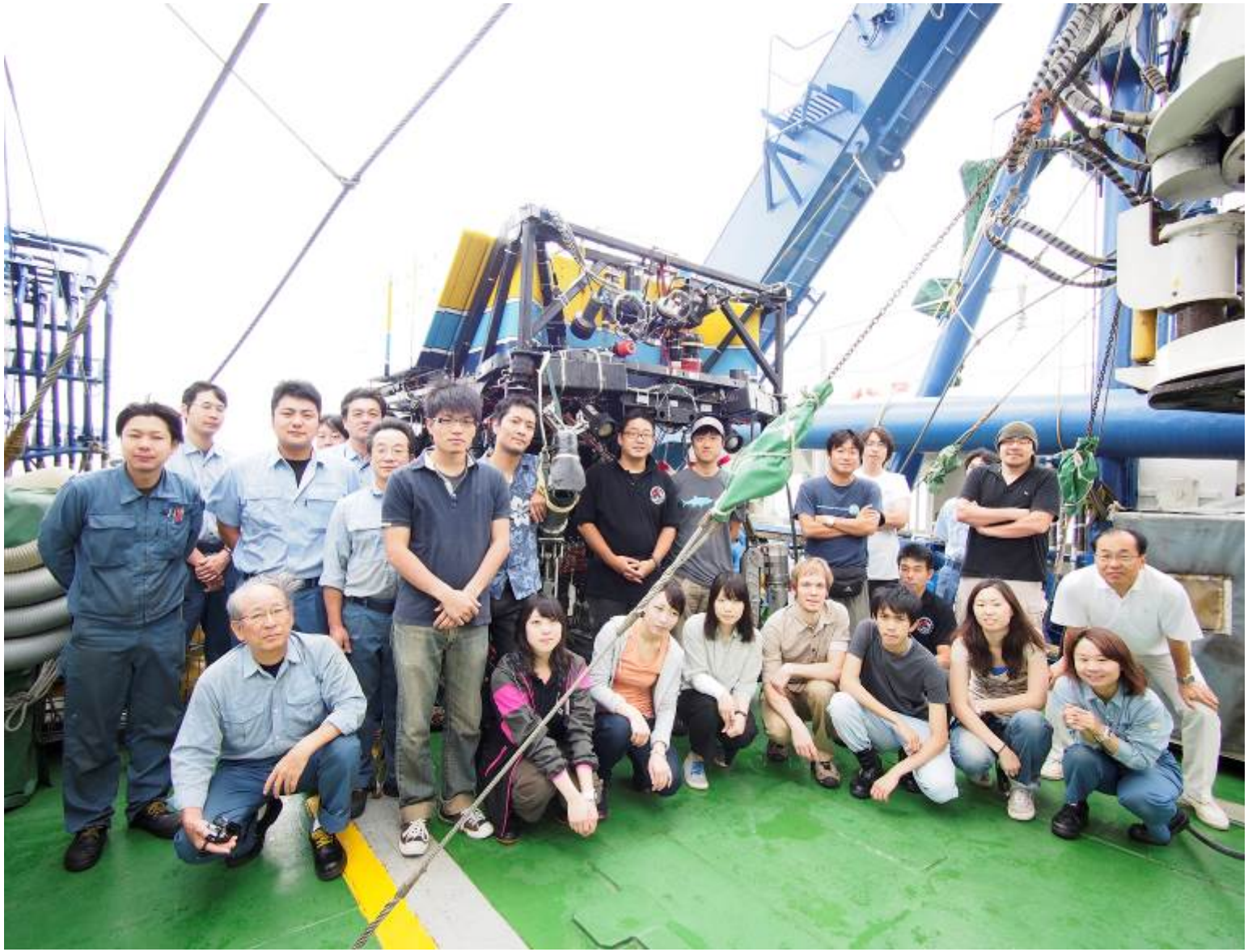
日付 Date	時間 Local Time	内容 Note	特記事項 Description	本船位置／気象／海象 Position/Weather/Wind/Sea condition
	20:30	scientific meeting		
23-Jun-12		ROV Hyper Dolphin dive 1394 and 1395		06/23 12:00 (UTC+9h)
	09:15	hoisted up HPD		35-05.6N,139-10.3E
	09:19	launched HPD		Off Atami
	09:32	started HPD#1394 dive operation	Sagami Bay	Overcast
	10:03	landed at sea bottom	Depth: 487m	SW-2 (Light breeze)
	12:22	left bottom	Depth: 487m	1(Calm)
	12:44	refloated HPD		1(Low swell shot)
	12:58	recovered		Visibly: 4'
	14:31	hoisted up HPD		
	14:36	launched HPD		
	14:48	started HPD#1395 dive operation	Sagami Bay	
	15:14	landed at sea bottom	Depth: 488m	
	18:01	left bottom	Depth: 489m	
	18:23	refloated HPD		
	18:38	recovered		
	18:40	commenced proceeding to JAMSTEC		
	19:00	scientific meeting		
24-Jun-12		Arrived at YOKOSUKA		
	09:00	arrived at YOKOSUKA		
	10:00	disembarked from NATSUSHIMA		
		finished NT12-15 cruise		

VII. Deployment and retrieval list (Photographs)



A: baby sperm whale calf “SAITO”; B:ADCP, C: vertebrae of beaked whale, D: sediment trap, E: Time-lapse still camera, F: TimerCam, G: Time-lapse video camera

VIII. Group portrait



IX. Miscellaneous photographs