Preliminary Report of The Hakuho Maru Cruise KH-07-2 Leg 1,3

Leg 1: Aug. 3, 2007 - Aug. 19, 2007
Leg 3: Sep. 1, 2007 - Sep. 15, 2007
(Eel Cruise XIV)

Atmosphere and Ocean Research Institute
The University of Tokyo
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By
The Scientific Members of the Expeditions

Edited by
Shun Watanabe, Kazuki Yokouchi
and Katsumi Tsukamoto

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KH-07-2 Cruise Report

Introduction

In the recent cruise of the R/V Hakuho-Maru KH-05-1, many newly-hatched pre-leptocephali of the Japanese eel were collected near a seamount during the new moon of June 2005. Based on this discovery we could successfully locate the spawning area of the Japanese eel precisely. This was the first clear evidence of a pinpoint spawning location of an anguillid eel in the world.

We planned this research cruise KH-07-2 for further understanding of spawning ecology and migration of the Japanese eel by collecting eel eggs and spawning adults. The main objectives of Legs 1 (August 3-19) and Leg 3 (September 1-15) were (1) to confirm the reproducibility of the distribution of pre-leptocephali near the seamount, and (2) determine the involvement of the seamount into eel spawning by collecting eel eggs and adults around the seamount.

Because of the calm sea during the cruise, we made almost 100% of sampling and observation scheduled. As a result, we could successfully collect the genetically identified pre-leptocephali during Leg 1 near the Suruga Seamount, confirming the spawning event of the Japanese eel near the seamount around new moon day (August 13). During Leg 3, we collected 56 possible anguillid preleptocephali and 96 anguilliformes eggs, which will be identified precisely by DNA sequencing in laboratory after cruise, although no adults were caught at the Suruga Seamount. Besides these samples, we collected more than 1200 specimens of anguillformes leptocephali and juveniles, which will be used for the early life history study of eels and the analysis of migration, spawning and diversity of anguillformes fishes in the western North Pacific. In addition to these main results on eels, we also made a big progress in biogeochemical understanding on the relationship between primary production and water disturbance by typhoon, and the distribution and biology of ocean skaters *Halobates* spp.

We acknowledge the captain and his crew of the R/V Hakuho Maru for their heartful cooperation.

September 15, 2007 In the cabin of Hakuho Maru

Katsumi Tsukamoto
Chief Scientist of KH-07-2

Station and working log.　KH-07-2_Leg1

No.1

2007	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
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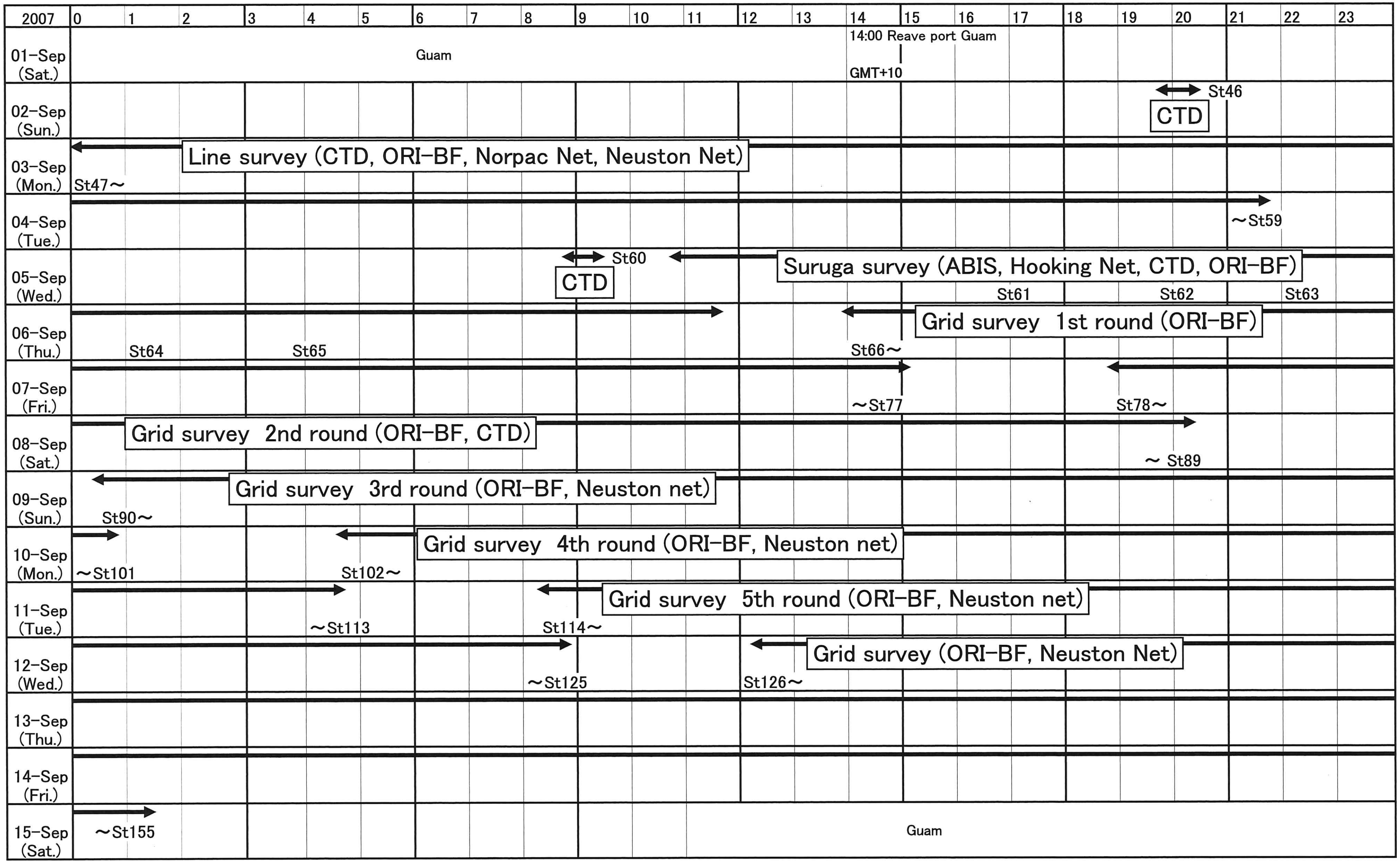
04-Aug (Sat.)																								
05-Aug (Sun.)									IKMT test													→→→ →→→ Clock Ahead →→→ GMT+10		
06-Aug (Mon.)																								
07-Aug (Tue.)			Path Finder survey (IKMT,ABIS,Hooking Net)																			Arakane survey		
08-Aug (Wed.)	(IKMT,ABIS,Hooking Net)														Suruga survey (IKMT,ABIS,Hooking Net,ORI-BF)									
09-Aug (Thu.)														XCTD			Arakane survey (IKMT,ABIS,Hooking Net,							
10-Aug (Fri.)	ORI-BF)						XCT						Suruga survey (IKMT,ORI-BF)											
11-Aug (Sat.)																								
12-Aug (Sun.)																								
13-Aug (Mon.)																								
14-Aug (Tue.)										St1		Grid survey (ORI-BF)	St2		St3		St4			St5		St6		
15-Aug (Wed.)	St7		St8			St9		St10			St11		St12		St13		St14			St15		St16		
16-Aug (Thu.)	St17		St18				St19		St20			St21			St34			St35			St37			St38
17-Aug (Fri.)			St39		St33			St22		St23			St32		St40		St41			St31		St24		
18-Aug (Sat.)	St25		St30		St25-2			St26		St29			St28		St45			St44		St43		St42		
19-Aug (Sun.)																	Guam							

Station and working log. KH-07-2_Leg3

No.2



Scientists on board HAKUHO-MARU (KH-07-2 Leg 1, 3)

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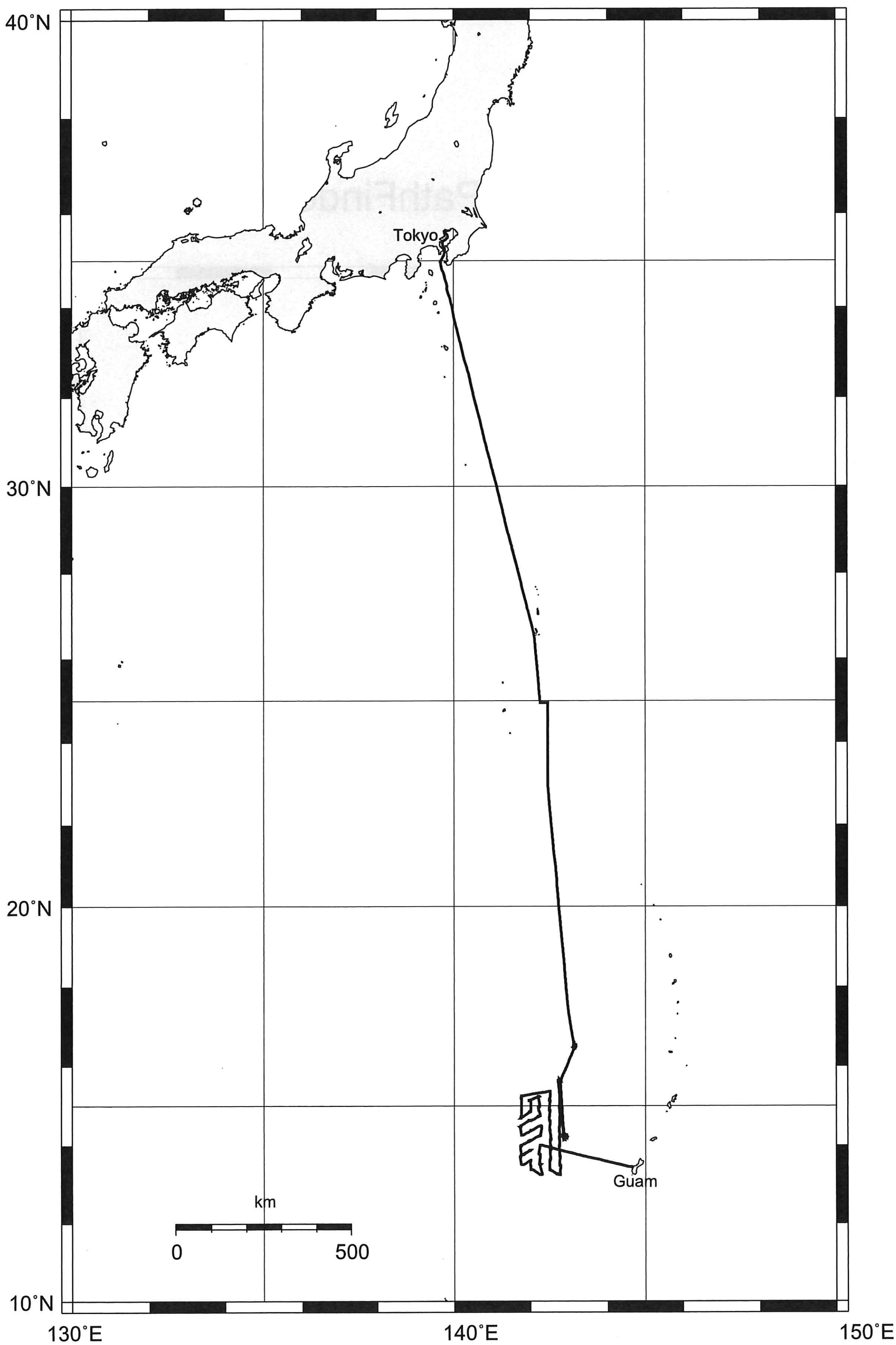
KH-07-2_Leg1 (Tokyo-Guam)



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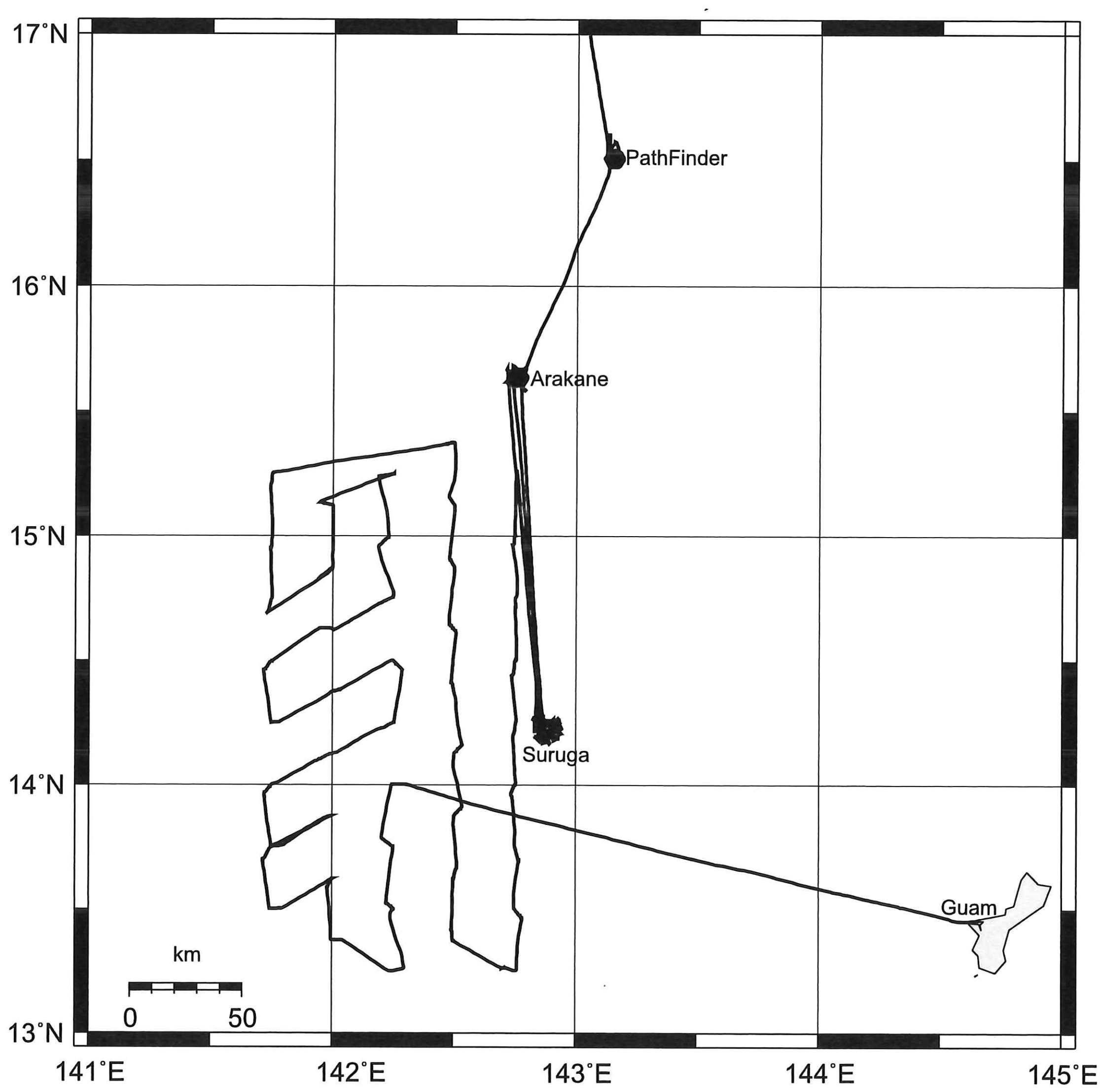

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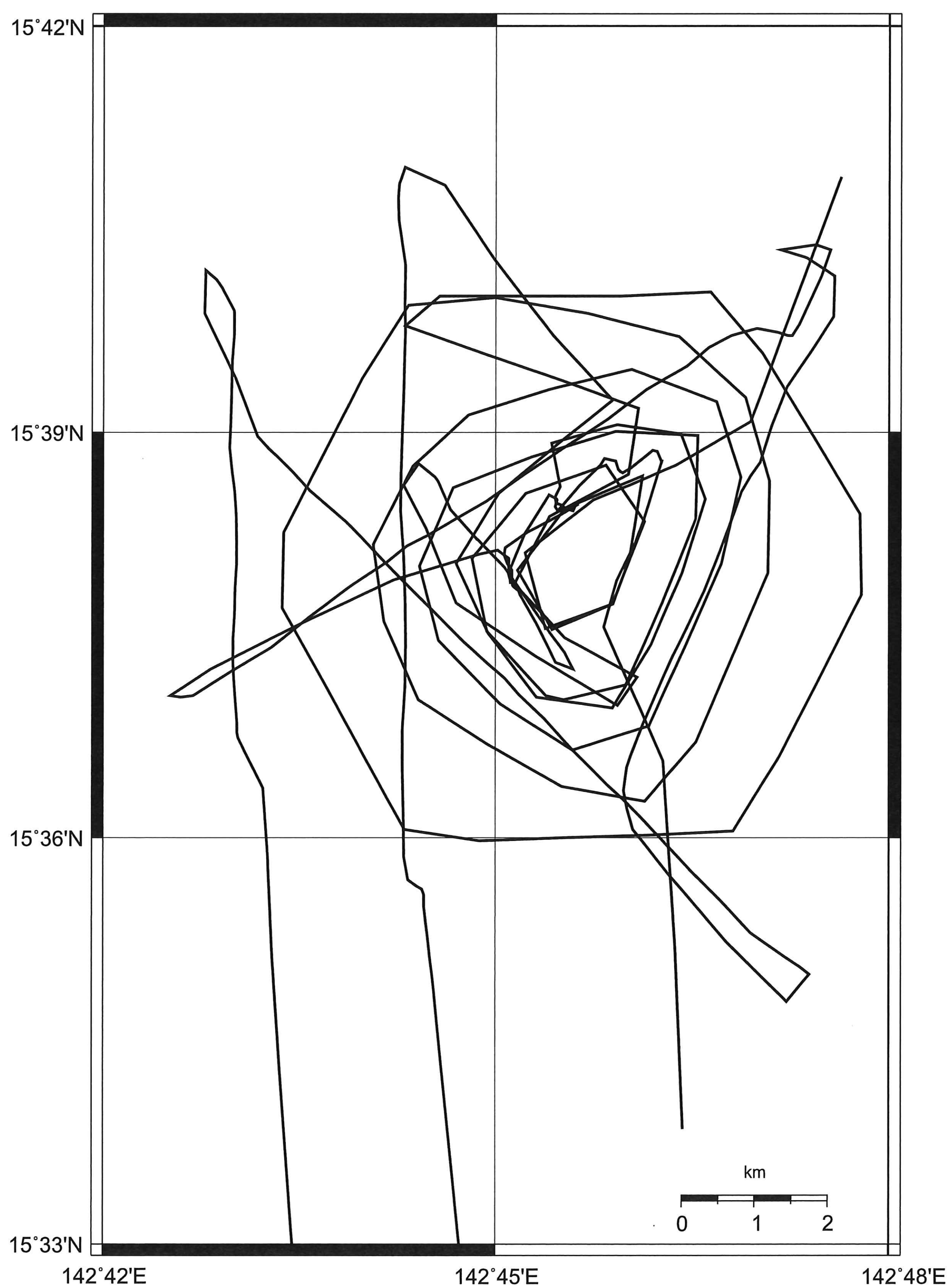
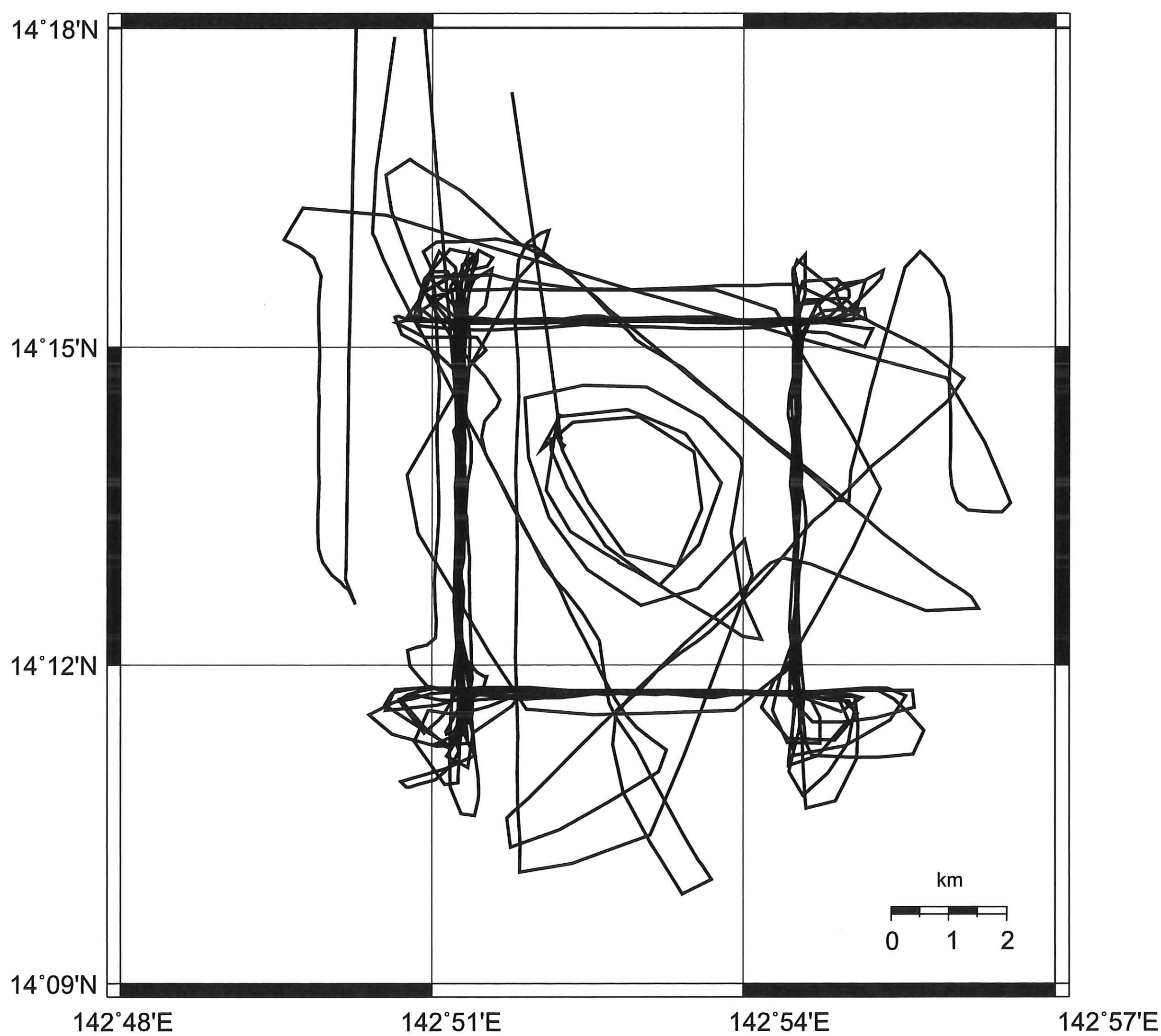


KH-07-2_Leg1 (Suruga)



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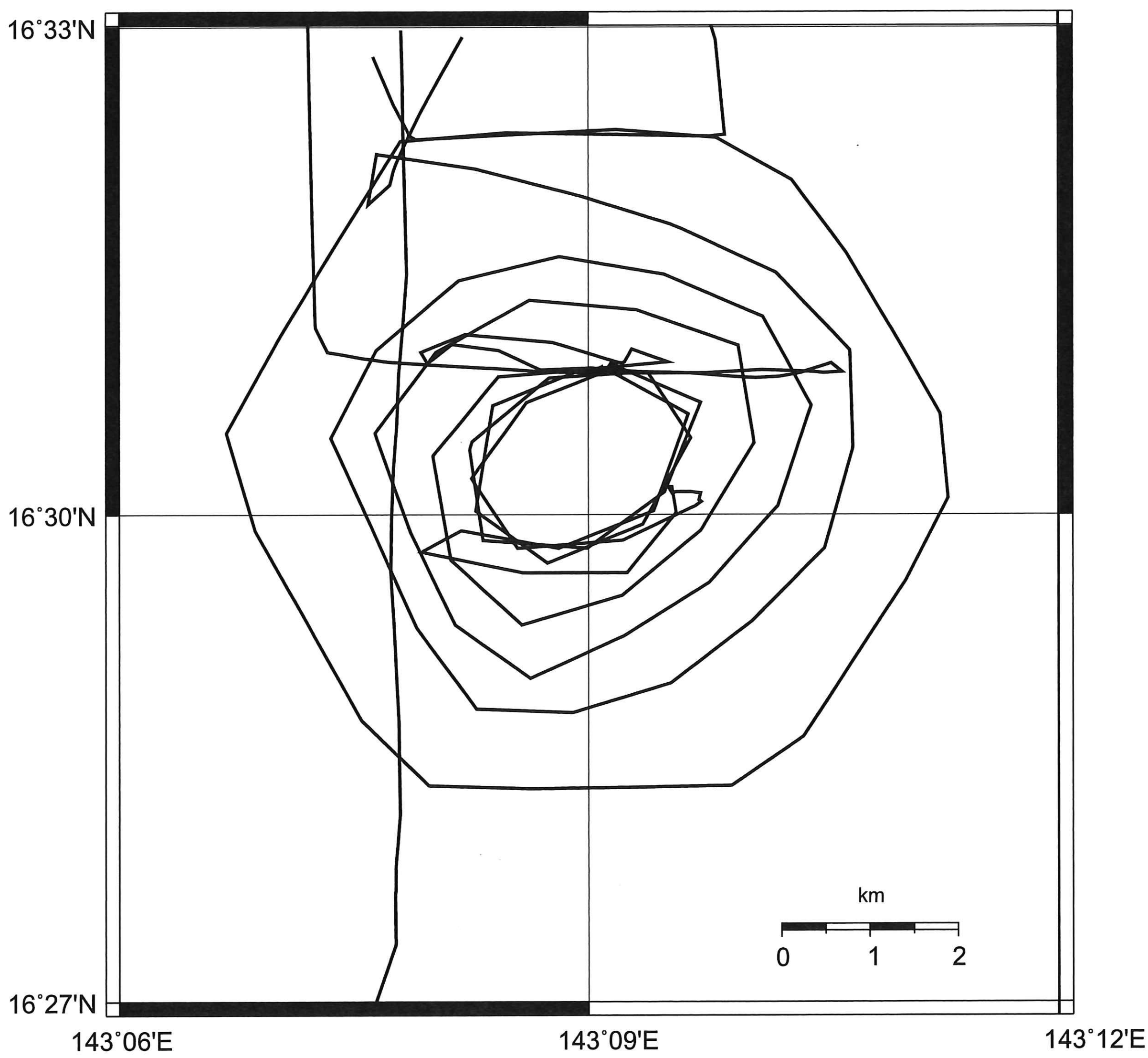

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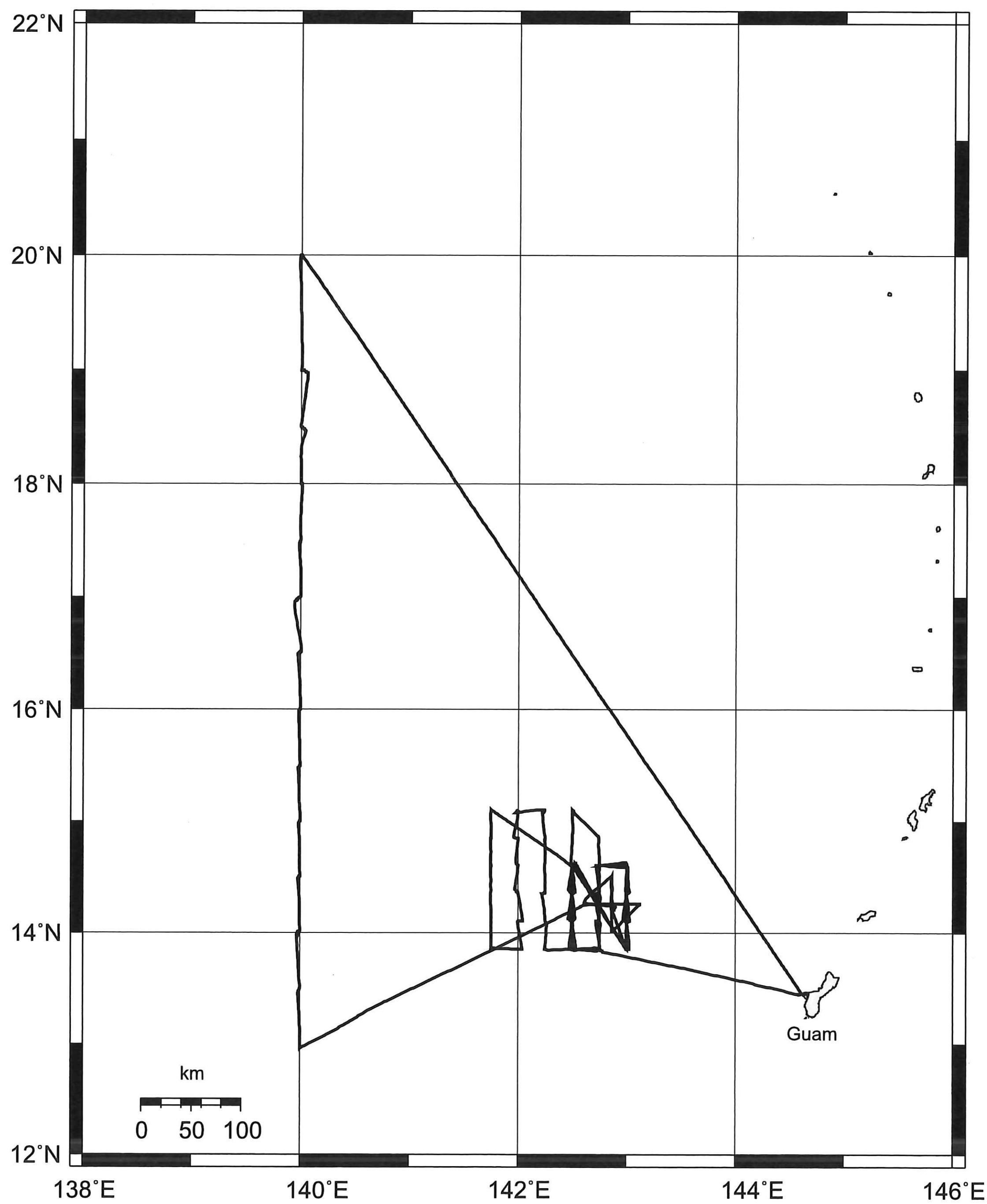
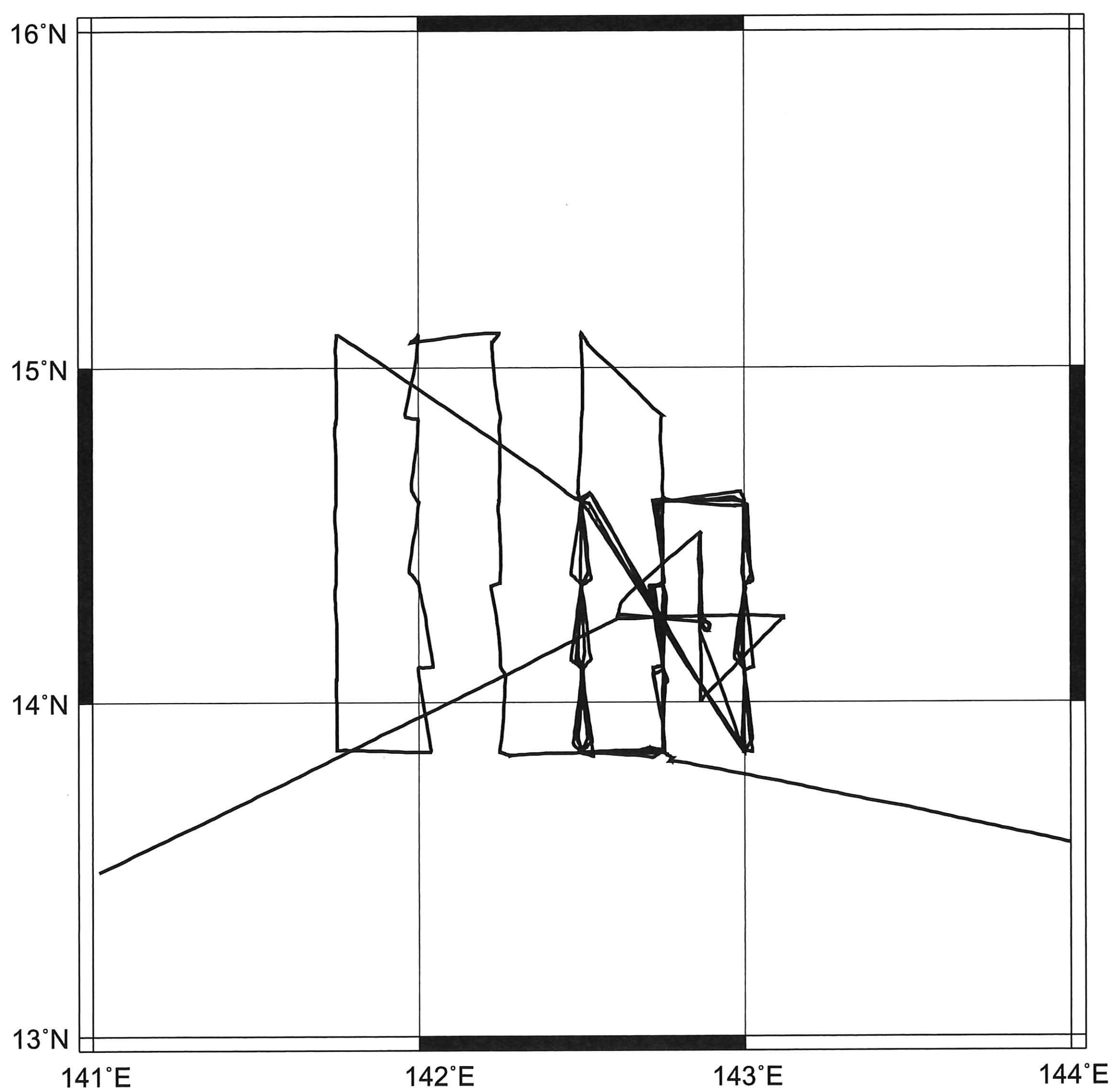


KH-07-2_Leg3 (Suruga Grid)



Studies on physical environments of eel larval transport

Kei Zenimoto, Sachie Miyazaki, Naoki Yamaoka and Takashi Kitagawa

The leptocephali of the Japanese eel (*Anguilla japonica*), a species that spawns only in the western North Pacific (Tsukamoto, 2006), have to migrate long distances to reach their preferred habitat in eastern Asia. Larval migration is governed by oceanic conditions, and the objectives of our study were therefore to investigate the hydrographic structures linked to the transport of Japanese eel larvae.

In KH-07-2, we conducted two types of observations to investigate physical conditions (conductivity, temperature, and depth). XCTD observations were conducted two stations between Suruga and Arakane seamounts during Leg 1. CTD observations were conducted at eight stations along 140 °E and five stations around Suruga seamount (Fig.1-1 and 1-2). As a result, salinity front (34.5 psu) was formed close to 18.5 °N. Sea surface temperature was totally uniform along 140 °E, although small thermal gradient was recognized at 100 to 300 m depths. Water current was also observed by Acoustic Doppler Current Profiler (ADCP, Fig.2-1, 2-2). Eastward in northern waters of 18 °N and westward in southern waters were observed. Analysis of detailed hydrographic structures is now in progress.

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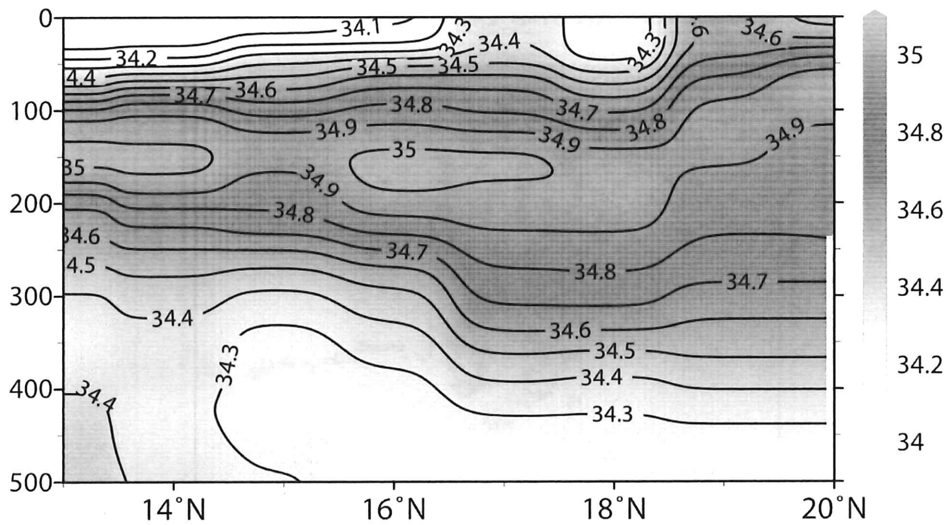

Fig. 1-1. Profiles of salinity (psu) at 140 ° E.

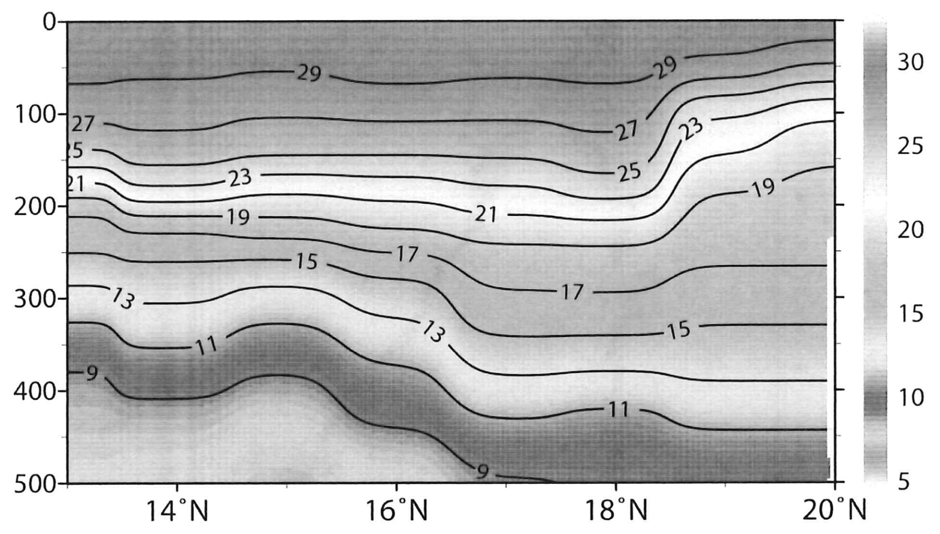

Fig. 1-2. Profiles of temperature (centigrate) at 140 ° E.

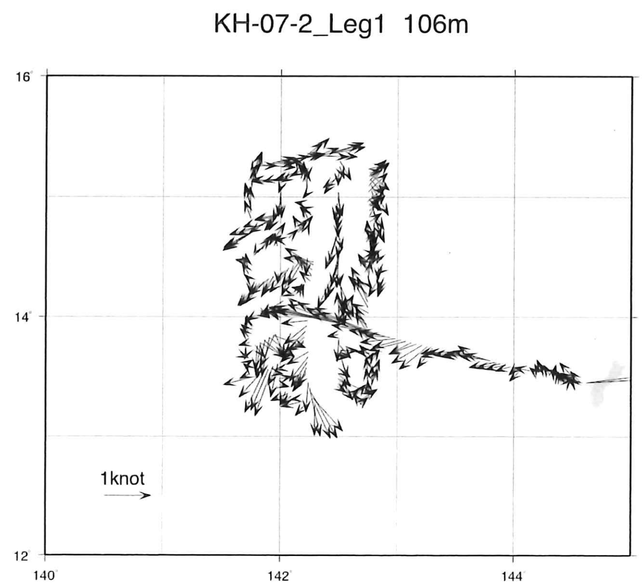

Fig. 2-1. Current vectors observed by ADCP during KH-07-2_Leg1.

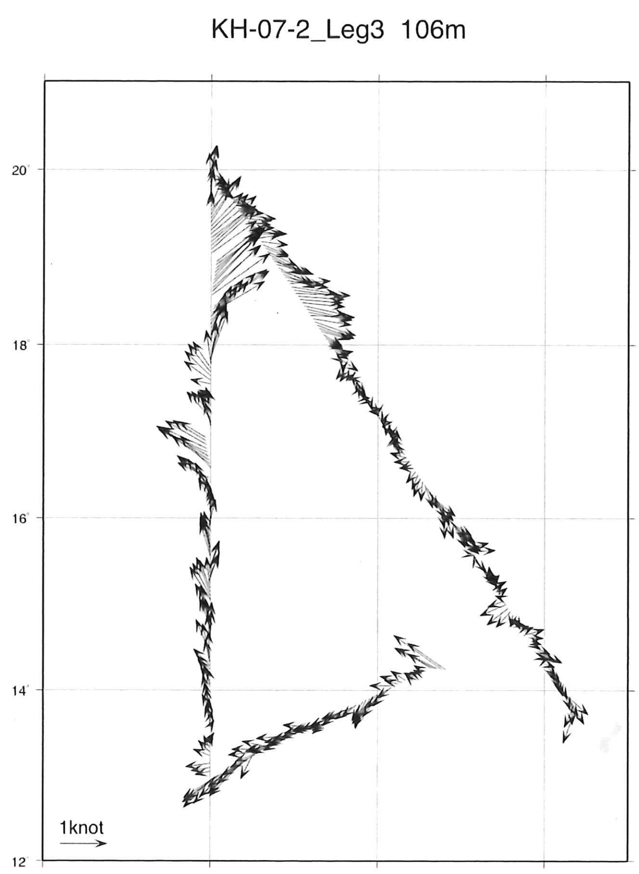

Fig. 2-2. Current vectors observed by ADCP during KH-07-2_Leg3.

Preleptocephali Collected During the KH-07-2 Cruise

All Scientists on Board

Sampling for preleptocephali of the Japanese eel, Anguilla japonica, was carried out using 167 net tows between 3 August and 15 September 2007 during KH-07-2. A total of 221 preleptocephali were collected using the 3-m ORI ring net during Leg 1 and 3 (Fig. 1, 2 and 3). The large ORI ring net had a 7.1 m2 mouth opening and 0.5 mm mesh. The nets were fished in step tows during Leg 1 and oblique tows during Leg 3. Sampling was primarily targeting eggs and preleptocephali of A. japonica. Most sampling for eggs and preleptocephali took place to near the Suruga seamount of the West Mariana Ridge where preleptocephali of the A. japonica were collected in 2005 (Tsukamoto, 2006). A total of 16 selected preleptocephali were tested using DNA nucleotide sequencing after Leg 1 (see Sudo et al, in this report). Seven preleptocephali of A. japonica were collected to the west of the Suruga seamount during Leg 1 (Fig. 1).

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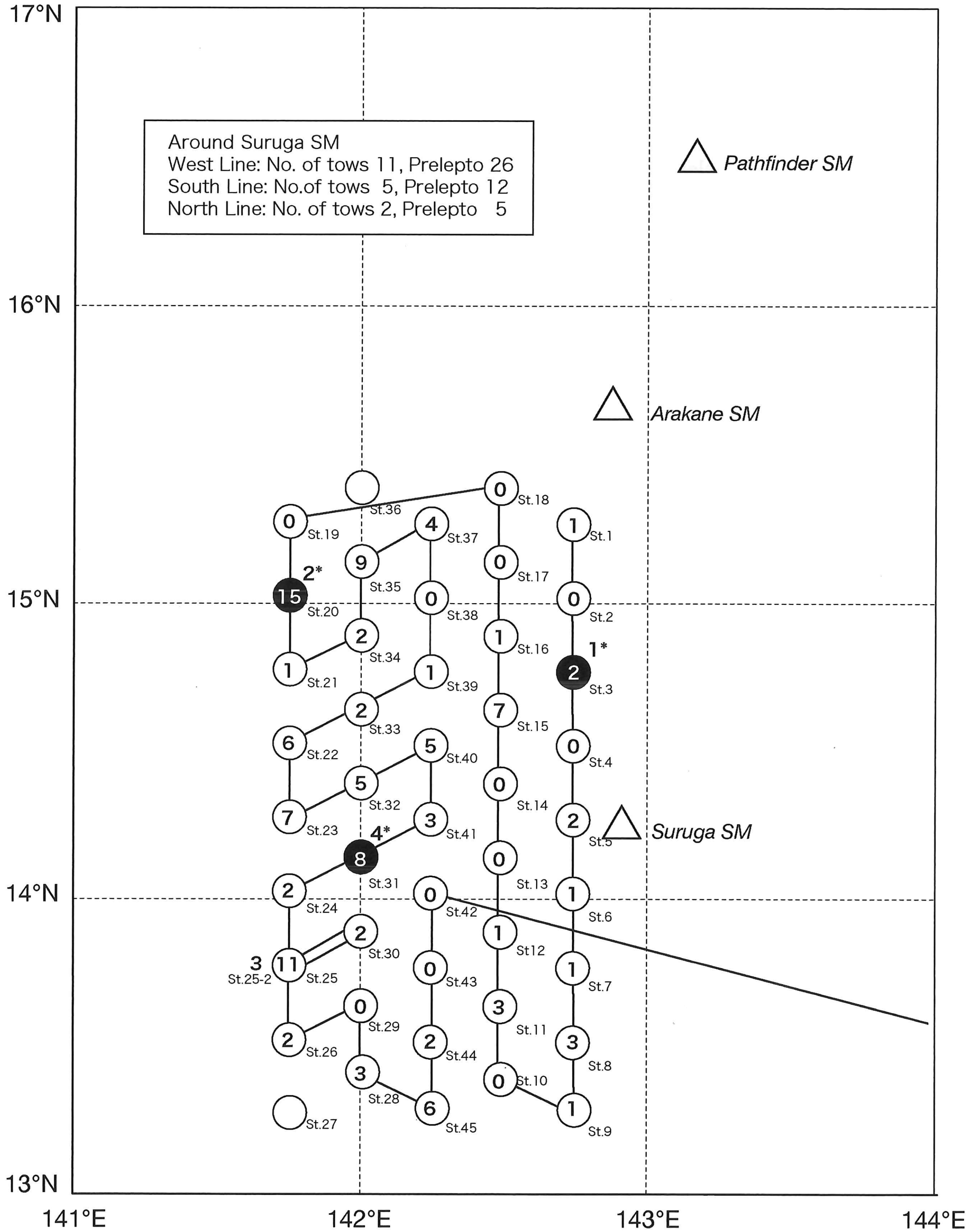

Figure 1. Map showing the sampling stations using the large size ORI net during Leg 1 of KH-07-2 cruise and the numbers in the circles were preleptocepali collected. Black circles indicate the stations where *A. jsponica* preleptocephali were collected (*numbers indicatte the specimens geneticaly identified as *A. japonica)*

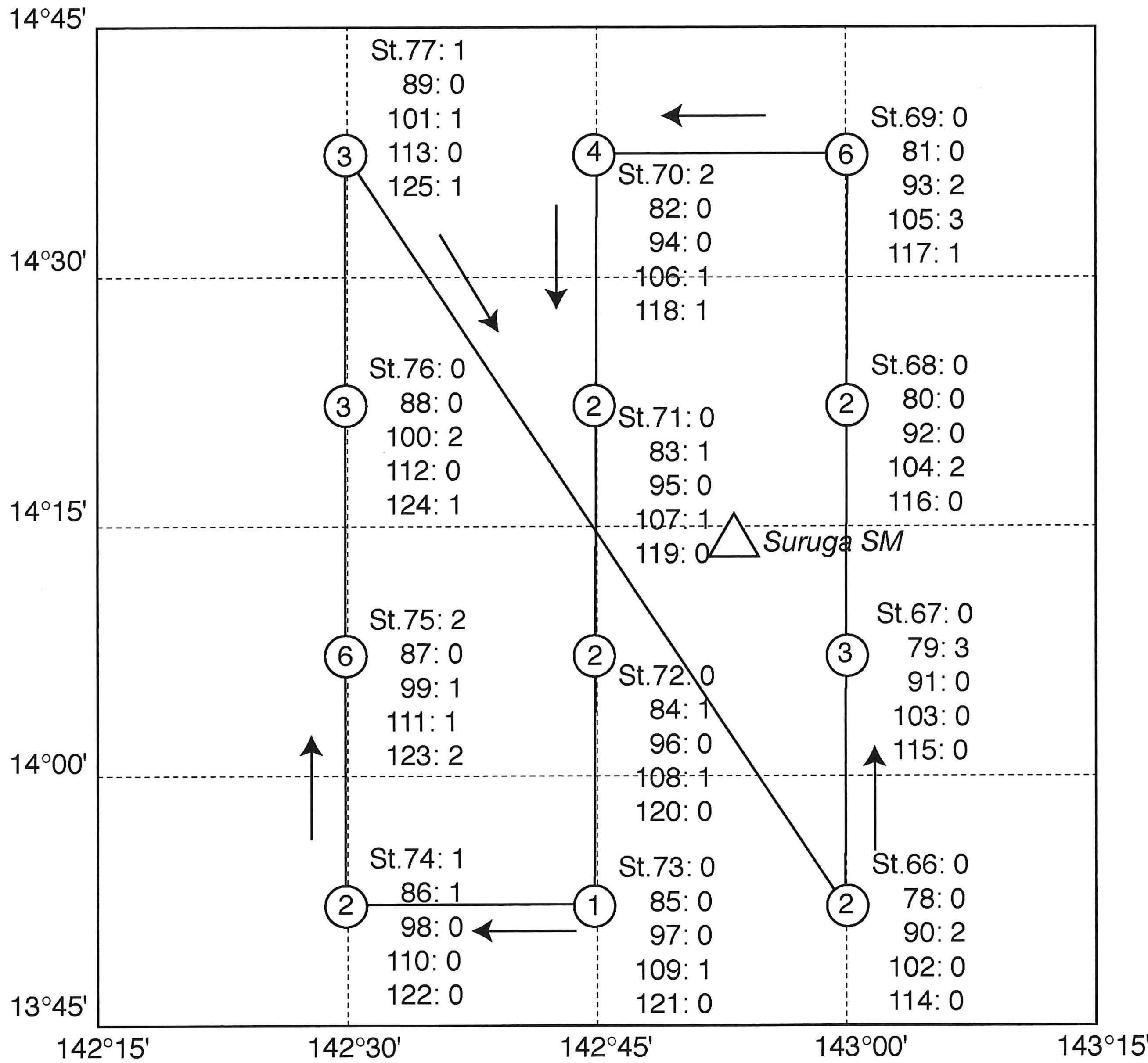

Figure 2. Map showing the sampling stations using the large size ORI net near Suruga seamout during Leg 3 of KH-07-2 cruise and the numbers in the circles were preleptocepali collected.

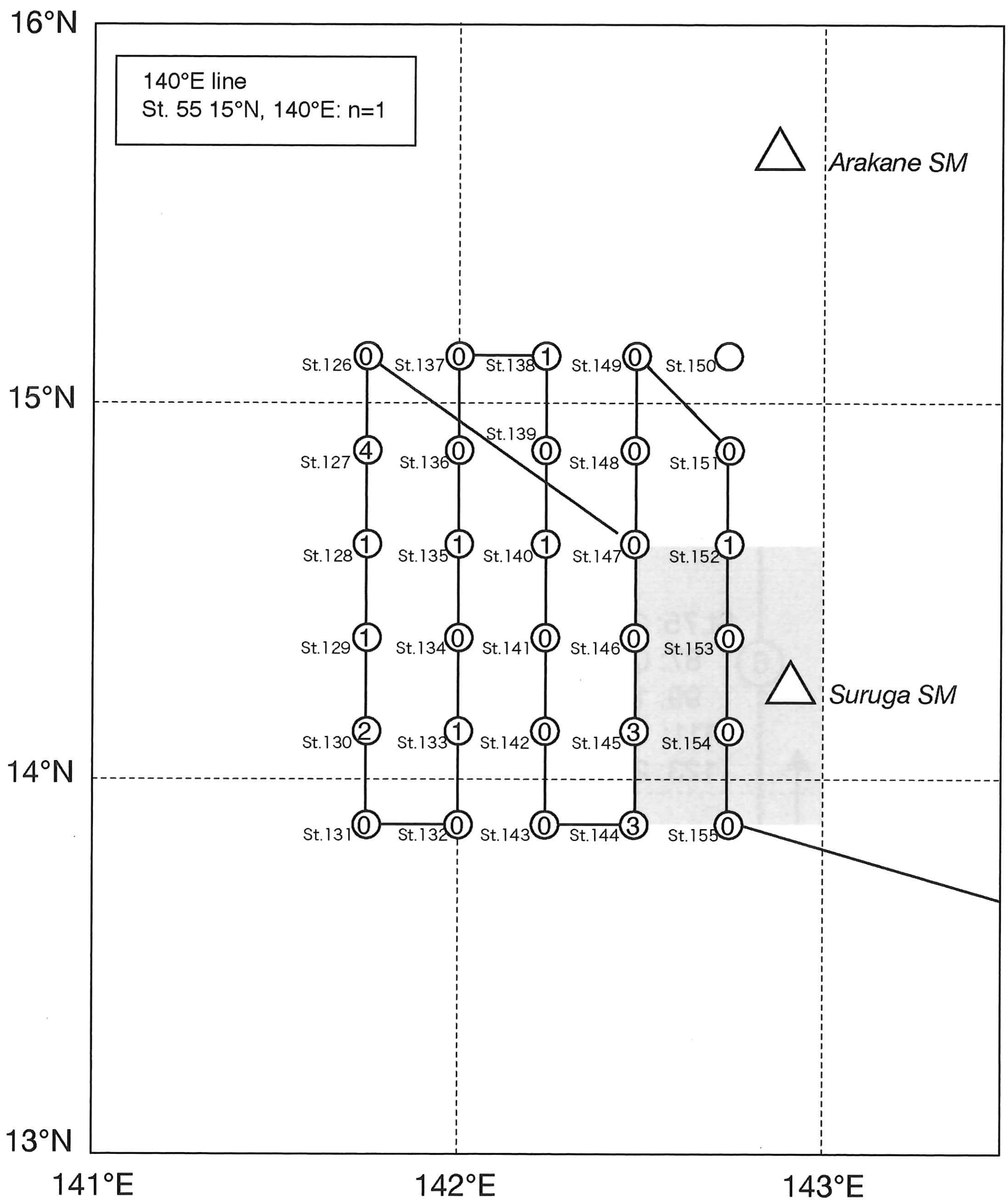

Figure 3. Map showing the sampling stations using the large size ORI net in the West of Suruga seamout during Leg 3 of KH-07-2 cruise and the numbers in the circles were preleptocepali collected.

Leptocephali collected during the KH-07-2 cruise

Mari Kuroki, Michael J. Miller, Noritaka Mochioka, Hiroaki Okazawa,
Seishi Hagihara, Etsuko Sawada, Atsushi Tawa, Jun Aoyama,
and Katsumi Tsukamoto

A total of 1200 leptocephali and 25 juvenile eels of at least of 16 families of eels and their close relatives were collected during the KH-07-2 cruise from 3 – 19 August 2007 (Leg 1) and 1 – 15 September 2007 (Table 1). These leptocephali were collected using the large ORI ring net with a 3 m diameter. The ORI ring net has a 7.1 m2 mouth opening and 0.5 mm mesh and was fished in oblique and step tows during both day and night.

The leptocephali of the mesopelagic eels of the Serrivomeridae (N = 643) were the most abundant family, which were collected at a wide range of sizes (Fig. 1), and 21 juvenile eels of this family were also collected. Even though the family Serrivomeridae was abundant in some areas in the western North Pacific area in past cruises, more than half of the total specimens (>54%) were Serrivomeridae during Leg 3 of the cruise this year (Fig. 1). Furthermore, many unidentified small preleptocephali and small leptocephali under 10 mm TL (N = 266) were collected (Fig. 1), but the majority of these may also be Serrivomeridae.

The leptocephali of the Congridae (N = 76) whose adults live in shallow water or on the upper continental shelf was the second most abundant family, with those of the genus Ariosoma being collected in the greatest numbers. The leptocephali of the shallow water eels of the Muraenidae were the third most abundant family (N = 60) and were collected at a wide range of sizes. Various species of the other shelf and slope eel families such as Chlopsidae (N = 21), Moringuidae (N = 2), Ophichthidae (N = 6), Nettastomatidae (N = 5), Synaphobranchidae (N = 20) were also collected. Leptocephali and a few juveniles of mesopelagic, bathypelagic, or deep-sea eels or their close relatives were collected, such as Nemichthyidae (N = 4), the Derichthyidae (N = 31), the Cyematidae (N = 7), other Saccopharyngifores (N = 21), and the Notacanthiformes (N = 2).

A unique aspect of the leptocephali catch data of the KH-07-2 cruise was that so many small sized leptocephali in the 5 – 15 mm TL range were collected. Morphological characters of most of these leptocephali were enough to determine that the large sized individuals were clearly of the family Serrivomeridae, as were many of the small specimens (Fig. 1, top panel). However, for many of the preleptocephali and even the smaller sized leptocephali, key morphological features such as the position of the last vertical blood vessel and the total number of myomeres were difficult to determine as a result of the fragility of preleptocephali, which are easily damaged, and because of the difficulty in seeing these features in such small individuals. The majority of these unidentifiable specimens were in the 5 – 9 mm TL range (Fig. 1, bottom panel). These factors highlight the value of onboard Real-Time PCR techniques that can determine if a tiny specimen is likely Anguilla or Serrivomeridae. Although, 12 preleptocephali have been genetically verified already as being Anguila japonica, future genetic analyses of the morphologically unidentified specimens shown in Figure 1 will reveal how many are Anguilla japonica, A. marmorata, Serrivomeridae, or other families.

Table 1. Numbers and sizes of the leptocephali collected during the two legs of the KH-07-2 cruise in the western North Pacific Ocean. 26 Juvenile eels of 3 families (79.4 – 225.5 mm TL) were also collected (not shown).

	Leg 1		Leg 3		Total	
	N	TL (mm)	N	TL (mm)	N	TL (mm)
Anguillidae	35	5.0-42.3	2	19.9-43.5	37	5.0-43.5
Congridae	42	42.5-260.0	34	8.4-272.0	76	8.4-272.0
Chlopsidae	14	24.3-74.3	7	15.0-78.3	21	15.0-78.3
Derichthyidae	8	6.3-40.1	23	5.7-81.0	31	5.7-81.0
Moringuidae	1	53.5	1	55.6	2	53.5-55.6
Muraenidae	33	35.0-83.9	27	7.8-75.0	60	7.8-83.9
Nemichthyidae	2	170.0-290.6	2	188.5-256.0	4	170.0-290.6
Nettastomatidae	0	-	2	7.2-112.6	2	7.2-112.6
Ophichthidae	4	6.4-84.5	2	75.3-162.5	6	6.4-162.5
Serrivomeridae	89	5.0-69.0	554	4.5-70.0	643	4.5-70.0
Synaphobranchidae	6	67.2-100.3	14	8.0-102.7	20	8.0-102.7
Cyematidae	3	10.3-21.1	4	9.0-13.5	7	9.0-21.1
Saccopharyngiformes	10	8.6-32.0	11	7.9-10.8	21	7.9-32.0
Notacanthiformes	4	85.0-290.0	0	-	4	85.0-290.0
Unidentified	141	2.3-61.3	125	4.7-33.3	266	2.3-61.3
Total	392	5.0-290.6	808	4.5-272.0	1200	2.3-290.6

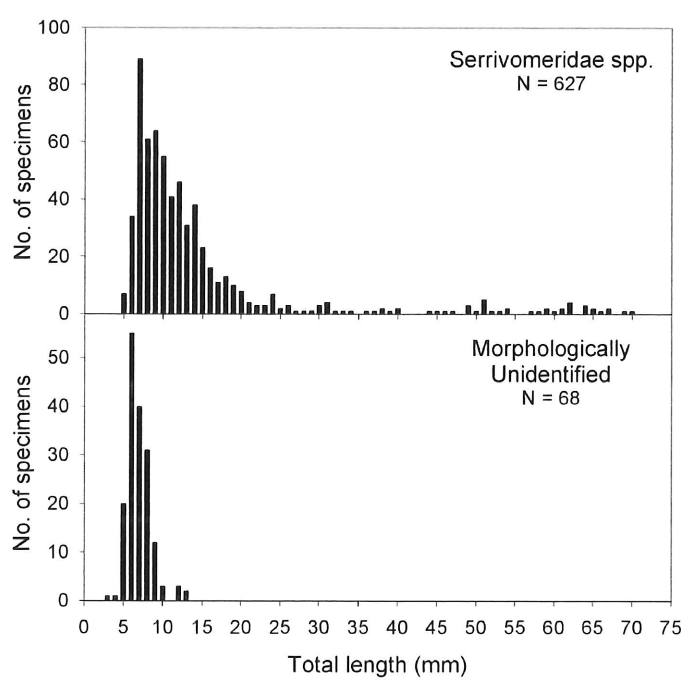

Figure 1. Length frequency plots of the preleptocephali and leptocephali that were identified as Serrivomeridae (top panel), and those that could not be identified to the family level (bottom panel).

Metamorphosing chlopsid leptocephali and other rare larval species near the Suruga Seamount

Michael J. Miller, Mari Kuroki, Noritaka Mochioka, Hiroaki Okazawa and Katsumi Tsukamoto

During the KH-07-2 cruise an unusually large number of metamorphosing leptocephali of the genus Kaupichthys were collected around the Suruga seamount, along with a variety of other types of rare leptocephali. Plankton tows with the large ORI ring net were made in close proximity to the seamount and were located above the lower reaches of the slope of the seamount. Tows of the IKMT with 5 mm mesh size were also made over the slope of the seamount. During the intensive step tow sampling in Leg 1 around the Suruga Seamount, 5 of the 10 Kaupichthys leptocephali that were collected were metamorphosing, and 2 of the metamorphosing specimens were collected by the IKMT 5 mm sampling. The metamorphosing specimens were 57.2 – 63.1 mm TL in size. This is a much higher percentage of metamorphosing specimens than ever collected before, because typically few or no metamorphosing specimens of this family are collected in offshore areas.

In comparison, during both the KH-04-2, and the KH-05-1 surveys in the North Equatorial Current region to the west of the seamounts, none of the 5 Kaupichthys specimens collected during each cruise were metamorphosing. Another example of the rarity of metamorphosing leptocephali of this genus was seen during a 2002 intensive survey for leptocephali around Sulawesi Island using the IKMT, which collected 2,335 leptocephali including 59 Kaupichthys leptocephali, but only one specimen (1.6 %) showed any morphological evidence of metamorphosis (Lee et al., In press). Similarly, during the 2001 survey around Sulawesi Island that collected 2,578 leptocephali (Wouthuyzen et al., 2005), only 4 out of 97 Kaupichthys (4.1%) were metamorphosing.

The morphological characteristics of metamorphosing leptocephali include a loss of teeth, a thickening of the head, and an anterior movement of the end of the gut towards the final position in the juvenile and adult eels (Otake, 2003; Miller and Tsukamoto, 2004). The metamorphosing Kaupichthys leptocephali collected during the KH-07-2 cruise showed these characteristics, as well as an enlargement of the olfactory rosette (Fig. 1A), which may be important in guiding active swimming towards their shallow water coral reef associated habitats using olfactory cues. Another unidentified species of chlopsid leptocephali was also collected around the Arakane seamount, which was undergoing metamorphosis (Fig. 1B). In addition to these metamorphosing chlopsid leptocephali, 6 metamorphosing Muraenidae were collected around the Suruga seamount (Fig. 1C) and 1 was collected around the Arakane seamount. Metamorphosing muraenids have occasionally been collected before in this region, but during the KH-07-2 cruise 1 specimen of the Ophichthidae genus Neenchelys (Fig. 1D), and one specimen of the Nettastomatidae genus Nettenchelys that were metamorphosing were collected for the first time in this region, or in any ORI associated sampling for leptocephali throughout the Indo-Pacific. In comparison, only a few large size non-metamorphosing specimens of these families were collected in the region during the KH-07-2 cruise.

The collection of a high percentage of metamorphosing leptocephali near the Suruga seamount where most of the sampling effort was carried out, suggests that the seamount is triggering metamorphosis in these larvae. It is possible that these leptocephali were spawned to the east somewhere along the Mariana Ridge, which includes Guam and Saipan at similar latitudes, and then were transported to the west by the North Equatorial Current to the seamounts of the West Marian Ridge. Then when they approached the seamount area by random chance, cues associated with the seamount triggered the process of metamorphosis. Alternatively, some species of leptocephali may have behavioral mechanisms that enable them to use active swimming to remain near the habitats where they were born, but this possibility lacks any data to enable even a tentative evaluation for leptocephali. Leptocephali may be good swimmers, and likely have good olfactory capabilities when they reach large sizes, so future research should consider these and other factors unique to leptocephali when exploring the triggering factors of metamorphosis and the recruitment mechanisms of marine eel larvae.

In addition to metamorphosing leptocephali of several families, various other rare leptocephali were collected during the KH-07-2 cruise. These included 16 specimens of gulper eels of the species, Eurypharynx pelecanoides (Fig. 2; order Saccopharyngiformes, family Eurypharyngidae), which were collected at small sizes (N = 15, 7.9 – 11.7 mm TL; N = 1, 32.0 mm) in various regions of the survey. Several specimens smaller than have been collected before in this region of Cyema atrum (Fig. 2; 9.0 – 12.2, 21.1 mm TL) of the family Cyematidae were collected, as well as 2 individuals of the Leptocephalus holti type (10.3 – 13.6 mm TL) also of this family, whose adult species are unknown.

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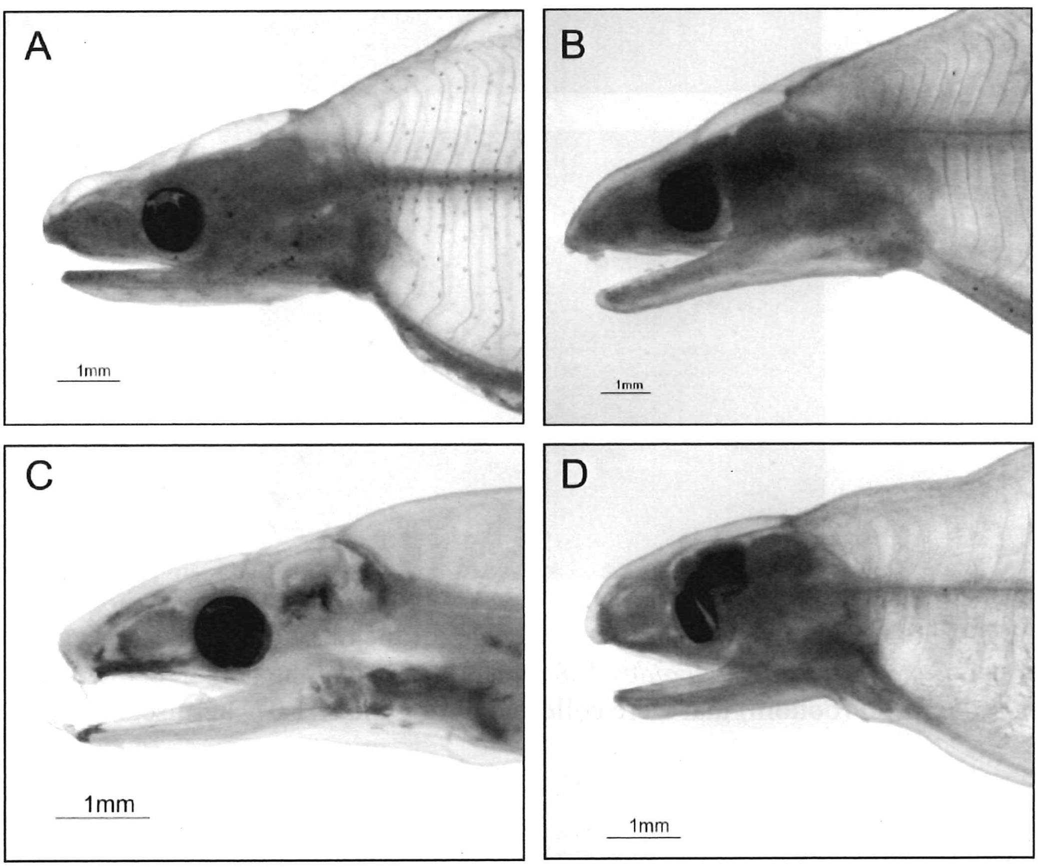

Figure 1. Photographs of metamorphosing leptocephali of a 57.2 mm TL chlopsid of the genus *Kaupichthys* (A), a 74.3 mm TL unidentified Chlopsidae sp. (B), a 84.5 mm TL ophichthid of the genus *Neenchelys* (C), and a 72.2 mm TL unidentified muraenid of the subfamily Uropteryginae (D), that were collected during the KH-07-2 cruise.

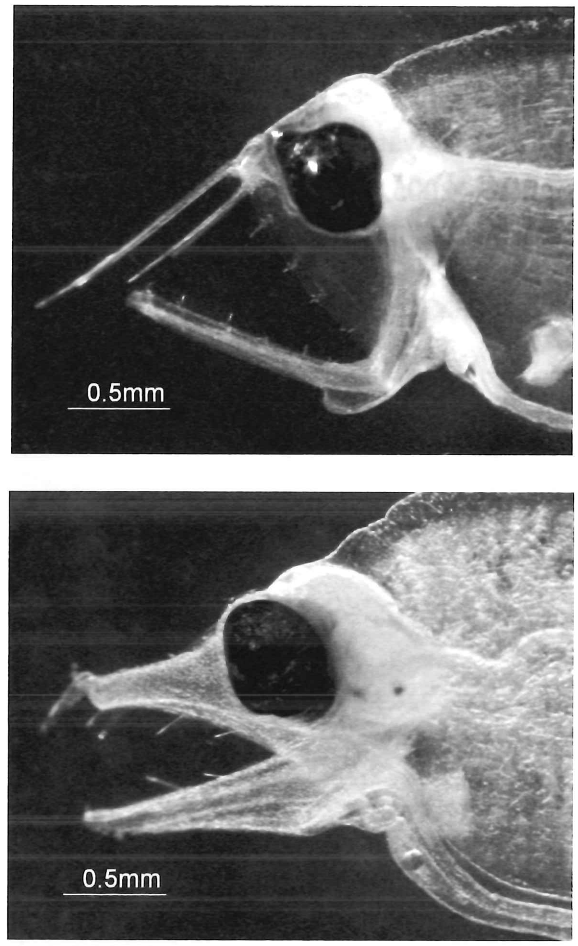

Figure 2. Photographs of small sized leptocephali of the meso- and bathy- pelagic gulper eel, *Eurypharynx pelecanoides*, 8.8 mm TL (top), and the bobtail eel, *Cyema atrum*, 9.0 mm TL (bottom) that were collected during the KH-07-2 cruise.

Age, Growth and Hatching Date of Anguilla japonica

Akira Shinoda, Mari Kuroki, Noritaka Mochioka, Etsuko Sawada, Seishi Hagihara, Tatsuki Yoshinaga, Michael J. Miller, Jun Aoyama and Katsumi Tsukamoto

In order to know the accurate hatching date of A. japonica, the head portion of preleptocephali collected during Leg 1 and 3 of the KH-07-2 cruise were sampled for later use in otolith microstructural analyses. Seven specimens were genetically identified as A. japonica after the Leg 1 (see Sudo et al, in this report, Table 1). One specimen had no eye pigment, and its developmental stage was similar with 2 days after hatching preleptocephali collected in 2005. The other six specimens had developed eye pigment and had a small oil droplet, and their developmental stages were similar with 5 days after hatching preleptocephali. On the assumption that these specimens were 2 days old and 5 days old, respectively, the hatching dates were estimated 11 and 12 August. The spawning dates were estimated as 9 and 10 August, and these dates were 2 and 3 days before new moon night (12 August). Further analysis in the laboratory after the cruise will use the otolith microstructure of the genetically identified preleptocephali to determine their exact ages and larval growth rates.

Table 1. The list of specimens number, station, collection date, estimated age, hatching date and spawning date of A. japonica preleptocepahli collected during KH-07-2.

No.	St.	Collection date	Estimated age	Hatching date	Spawning date
181	3	14.Aug.07	2	12.Aug.07	10.Aug.07
242	20	16.Aug.07	5	11.Aug.07	9.Aug.07
245	20	16.Aug.07	5	11.Aug.07	9.Aug.07
321	31	17.Aug.07	5	12.Aug.07	10.Aug.07
323	31	17.Aug.07	5	12.Aug.07	10.Aug.07
324	31	17.Aug.07	5	12.Aug.07	10.Aug.07
325	31	17.Aug.07	5	12.Aug.07	10.Aug.07

Distribution and migration of tropical anguillid leptocephali in the western North Pacific Ocean

Mari Kuroki, Jun Aoyama, Michael J. Miller, and Katsumi Tsukamoto

Two-thirds of the 18 species/subspecies of anguillid eels worldwide are tropical species (Ege 1939, Castle and Williamson 1974). Learning about the life histories of tropical species, which appear to be the most ancestral (Aoyama et al. 2001), is essential for understanding the evolution and larval ecology of this remarkable group of catadromous fishes. However, most studies on the early life history of anguillid eels have been made on temperate species, and relatively little information has been published on the larval distributions and migration of tropical anguillid eels. Recently, it was revealed that tropical eels of A. marmorata and A. bicolor pacifica in the western North Pacific Ocean region have higher larval growth rates and shorter oceanic larval durations than temperate eels such as A. japonica based on otolith analysis (Kuroki et al. 2006). Nonetheless, information about the detailed spawning areas and geographic distribution patterns of these tropical eels has been lacking. In this cruise we aimed to collect the leptocephali of the tropical anguillid eels and reveal the distribution patterns in the western North Pacific Ocean for understanding their spawning ecology and larval migration.

Both A. marmorata and A. bicolor pacifica leptocephali were collected during the KH-07-2 cruise during 3 – 19 August 2007 (Leg 1) and 1 – 15 September 2007 (Leg 3). These leptocephali were collected using the large ORI ring net with a 3 m diameter. The ORI ring net has a 7.1 m2 mouth opening and 0.5 mm mesh. The net was fished in oblique and step tows during daytime and nighttime. Collected leptocephali were observed and measured on board. Total myomeres, preanal myomeres, predorsal myomeres, number of myomeres of the blood vessels, total length, preanal length, predorsal length, head length, and body depth were measured and counted using a dissecting microscope (Nikon SMZ-1500). After the morphological measurement, the leptocephali were preserved in 95% ethanol for identification using mitochondrial DNA 16S ribosome RNA sequence and for otolith aging analysis.

A total of 5 leptocephali of A. marmorata over 10 mm TL (11.0 – 27.6 mm TL) were collected during Leg 1 of the cruise (Table 1, Figure 1). A large number of small anguillid preleptocephali that had oil globules and small leptocephali under 10 mm TL (N = 56, 3.7 – 8.1 mm TL) including A. marmorata were collected in the region to the west of the Mariana Islands confirms the presence of a spawning area of this species in this region as has been previously suggested (Miller et al. 2002, Kuroki et al. 2006). As is well known widely, the spawning area of Anguillia japonica is located to be west of the Mariana Islands in the western North Pacific Ocean (Tsukamoto 1992, 2006). Leptocephali of two other anguillid species, A. marmorata and A. bicolor pacifica, are also distributed in this area. This represents the first collection of preleptocephali of A. marmorata ever verified because some of the preleptocephali from Leg 1 have been identified using mtDNA in the laboratory. The genetic identification of all the other specimens that are possibility of an anguillid species will be done after the cruise, because the morphological characters for identification are limited for these undeveloped small leptocephali. The A. marmorata spawned in this research region would first be transported westward by the North Equatorial Current and then some would be transported northward into the Kuroshio and others transported southward by the Mindanao Current.

A total of 3 leptocephali of A. bicolor pacifica were collected during Leg 1 and Leg 3 of this cruise. Two of the leptocephali were large (42.3, 43.5 mm TL), but the other leptocephalus was relatively small (22.0 mm TL). This 22.0 mm TL leptocephalus of A. bicolor pacifica was the smallest ever recorded, because only large leptocephali over 40 mm TL have been collected in this region or elsewhere (Kuroki et al. 2006). The spawning area of this mysterious species is still not known, however.

The geographic distribution patterns and the size of tropical eels of A. marmorata and A. bicolor pacifica will be compared with the distribution of the leptocephali collected during the cruise and the larval migration will be discussed in relation to ocean current conditions. These results will also be compared with the temperate A. japonica collected in this region and other tropical eels to reveal the specific strategy of migration and recruitment of tropical eels (Kuroki et al. 2006, 2007). The otolith microstructure of both species of leptocephali collected during the cruise will be analyzed as part of an ongoing larger study on the early life history as age and growth of tropical anguillid leptocephali.

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Table 1. Collection data of morphologically identified tropical anguillid leptocephali over 10 mm TL.

Cruise	Leg	Specimen No.	Collection Date	Stn.	Latitude	Longitude	Total length (mm)	Species
KH-07-2	Leg.1	33	2007.8.10	A15	15°40'N	142°43'E	27.6	*Anguilla marmorata*
KH-07-2	Leg.1	204	2007.8.15	11	13°38'N	142°30'E	42.3	*Anguilla bicolor pacifica*
KH-07-2	Leg.1	227	2007.8.16	19	15°15'N	141°45'E	11.0	*Anguilla marmorata*
KH-07-2	Leg.1	228	2007.8.16	19	15°15'N	141°45'E	13.0	*Anguilla marmorata*
KH-07-2	Leg.1	246	2007.8.16	20	15°00'N	141°45'E	11.0	*Anguilla marmorata*
KH-07-2	Leg.1	254	2007.8.16	34	14°50'N	142°00'E	22.0	*Anguilla bicolor pacifica*
KH-07-2	Leg.3	451	2007.9.6	65	14°30'N	142°52'E	43.5	*Anguilla bicolor pacifica*
KH-07-2	Leg.3	985	2007.9.12	131	13°51'N	141°45'E	19.9	*Anguilla marmorata*

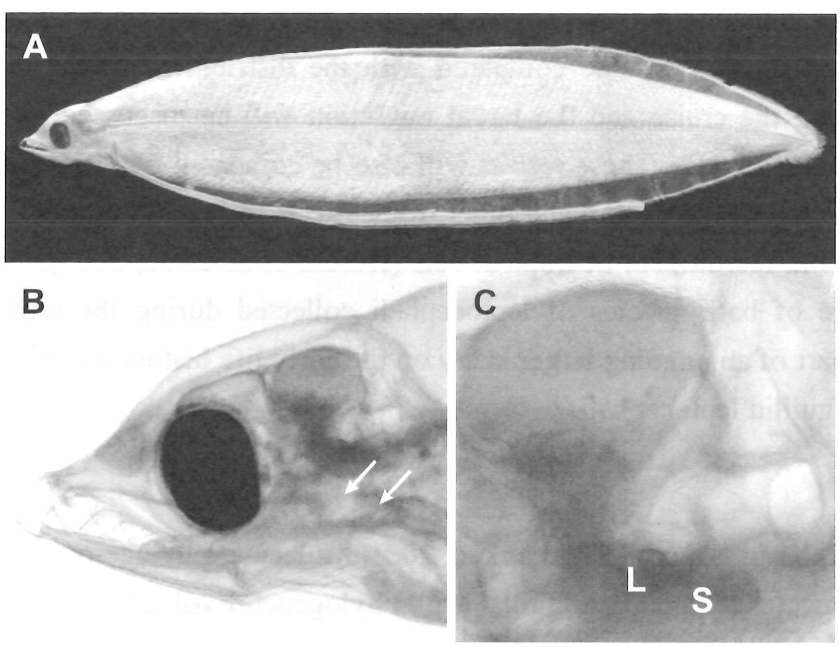

Figure 1. A: *Anguilla marmorata* leptocephali (No.33, 27.6 mm TL), B: Head part of leptocephalus and arrows showing the location of otoliths, and C: the sagittal (S) and lapillar otoliths (L).

Species identification of Serrivomeridae specimens during the KH-07-2 cruise

Etsuko Sawada, Hiroaki Okazawa, and Katumi Tukamoto

Pelagic eels of the family Serrivomeridae include 2 genera with about 10 species (Nelson, 1994) that are widely distributed from tropical to temperate regions in the Pacific, Atlantic and Indian Oceans (Castle, 1969). However, their taxonomy or population structures have never been studied comprehensively because it is difficult to catch their adults, which are morphologically well developed and indispensable for taxonomic studies. Their larvae, called "leptocephali", are much less morphologically developed than adults and are impossible to exactly identify to the species level. Bauchot (1959) divided leptocephali of the family Serrivomeridae into 4 types morphologically. However the number of species suggested from the adult specimens were 10, and their relationships with the types of leptocephali were not known.

Thus, we examined the genetic differences of Serrivomeridae specimens collected during the KH-07-2 cruise (Table 1) to determine their species composition or population structure using molecular genetic characters within a portion of about 1000 bp of their mitochondrial 16SrRNA sequences. These genetic data will enable us to evaluate Bauchot's larval types and to find key characters for identification of these leptocephali. Further, the distribution of eggs and preleptocephali that are genetically identified will provide important information about their early life history and spawning sites.

Table 1. Number of Serrivomeridae specimens collected during KH-07-2.

Life history stage	Leg1	Leg3
Egg/preleptocephali *	36	38
Leptocephali	74	617
Juvenile	9	14
Total	119	669

* Total Length < 10 mm

The biology of deep-sea eels of the family Synaphobranchidae

Seishi Hagihara, Michael J. Miller, and Katsumi Tsukamoto

The fishes of deep-sea eel family Synaphobranchidae are distributed worldwide and live in relatively deep waters (mostly between 400 and 2000 m). However, biological knowledge concerning the Synaphobranchidae is scarce because the data collection process remains difficult. The main purpose of this study is to learn about the biological characteristics of the Synaphobranchidae, with a particular focus on their distribution patterns and early life history. During the KH-07-2 cruise, at least 4 species of synaphobranchid leptocephali were collected. These included Dysomma anguillare (N = 4, 57.2 – 88.0 mm TL), including a metamorphosing leptocephalus (Fig. 1B), two other species also of the subfamily Ilyophinae (62 and 64.7 mm TL), including a leptocephalus with a long rostral cartilage (Fig. 1C), as well as 14 leptocephali of various sizes of the subfamily Synaphobranchinae from 8.0 – 102.7 mm TL (Fig. 1A).

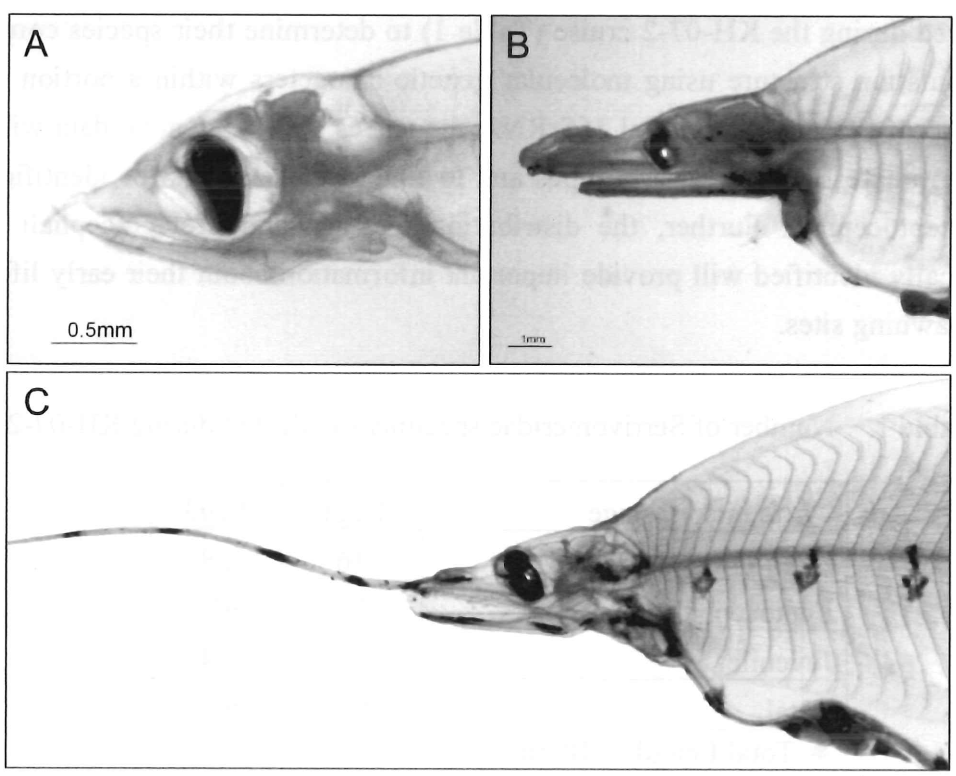

Figure 1. Rare specimens of 3 species of leptocephali of the family Synaphobranchinae collected during the KH-07-2 cruise that included an unusually small specimen (18.0 mm TL) of the subfamily Synaphobranchinae (A), a metamorphosing 88.0 mm TL *Dysomma anguillare* (B), and a 64.7 mm TL undescribed Ilyophinae species with a long rostral cartilage.

Muraenid Leptocephali Collected During Leg 3 of the KH-07-2 Cruise

Atsushi Fukkui, Nobuyuki Mizusawa and Takaaki Tamai

A total of 26 leptocephali of the Muraenidae were collected during Leg 3. These leptocephali were collected using the 3-m ORI ring net during Leg 3. The large ORI ring net had a 7.1 m2 mouth opening and 0.5 mm mesh. The net was fished in oblique tow during daytime and nighttime. These leptocephali were separated into two subfamilies(Table 1). The subfamily Muraeninae can be distinguished because their dorsal and anal fins extend relatively far forward compared to the subfamily Uropterygiinae, which have dorsal and anal fins that do not extend very far forward. However, the individuals smaller than about TL 20-mm were difficult to identify because their anal and dorsal fins were undeveloped. Therefore, for classification of the Muraenidae it is necessary for new characters such molecular genetics and more detailed observation of other morphological features such as pigmentation to be developed.

Table 1. Sampling station and the general body features of the muraenid leptocephali

St.	Subfamily	TL	PAL	TM	LBVB	PAM
48	Uropterygiinae	43.0	23.0	107	54	58
75	Muraeninae	43.3	21.8	130	61	58
95	Muraeninae	73.9	42.8	132	64	70
98	Uropterygiinae	16.9	15.2	158	97	107
99	Unknown	19.5	14.0	96	45	49
108	Muraeninae	43.5	22.6	118	62	56
110	Unknown	15.5	10.0	102	52	61
110	Uropterygiinae	24.7	17.8	133	66	71
110	Uropterygiinae	25.9	18.4	129	63	69
118	Muraeninae	56.7	32.0	106	57	55
121	Unknown	11.7	9.1	140	66	73
121	Unknown	11.0	8.6	117	60	67
127	Muraeninae	62.5	34.0	104	55	53
127	Muraeninae	33.3	29.4	168	99	115
130	Unknown	23.0	16.0	134	66	77
130	Unknown	17.2	13.6	132	69	80
133	Unknown	75.0	46.6	135	71	76
133	Unknown	14.0	9.7	137	68	63
133	Unknown	15.5	11.2	125	62	63
135	Unknown	16.7	12.8	115	58	66
141	Unknown	23.0	16.2	111	55	64
145	Unknown	24.8	17.0	131	65	70
154	Muraeninae	57.3	29.5	126	59	58
154	Unknown	30.6	21.2	113	59	65
155	Unknown	22.6	15.8	149	67	72
155	Unknown	17.8	14.3	139	76	91

TL : total length, PAL : preanal length, TM : total myomeres, LVBV : last vertical blood vessel, PAM : preanal myomeres.

Studies on the fishes collected during KH-07-02 cruise –Systematics of opisthoproctid fishes–

Atsushi Tawa and Noritaka Mochioka

Opisthoproctid fishes (Argentinoidei: Argentiniformes) distributed worldwide in oceanic midwater depths. They are characterized by dorsally or anterodorsally directed eyes, very narrow interorbital, small mouth, and dorsal fin in posterior half of body, being composed of the following seven genera: Dolichopteryx Brauer, 1901 (7 in number of valid species), Bathylychnops Cohen, 1958 (2), Ioichthys Parin, 2004 (1), Macropinna Chapman, 1939 (1), Opisthoproctus Vaillant, 1888 (2), Rhynchohyalus Barnard, 1925 (1), Winteria Brauer, 1901 (1). Of them, Dolichopteryx has exhibits neotenic characters, the internal organ being enclosed by the peritoneum and skin as a result of the hypaxial musculature being undeveloped along the ventral margin of the body. A specimen of Dolichopteryx (IORD 04-63) collected during KH-04-02 cruise exposed the systematic problems possessed in the genus. After that, the first author described two new species, Dolichopteryx rostrata Fukui and Kitagawa, 2006 and Dolichopteryx minuscula Fukui and Kitagawa, 2006. Furthermore a new species is contributing to Ichthyological Research at the present. However, the systematics of Dolichopteryx remained several problems. For example, Dolichopteryx binocularis Beebe, 1932 is divided two types on the basis of the differences of the relative position of dorsal and anal fins and melanophore patterns. On the other hand, the systematics is not clear in Bathylychnops. The meristic counts of larvae ascribed to Bathylychnops in the western North Pacific do not correspond to those of any adults of the genus. Therefore, the systematics of Opisthoproctidae, especially Dolichopteryx and Bathylychnops, should be reviewed. In addition, the ontogeny of opisthoproctid fishes is not known to date.

A total of 16 opisthoproctid fishes were sorted out during KH-07-02 cruise (Table 1). After taking photographs, they were fixed in approximately 10% sea water formalin (some in 99 % ethanol). We will carry out systematic study of Opisthoproctidae using their specimens and those deposited in the museum, moreover make the ontogeny clear.

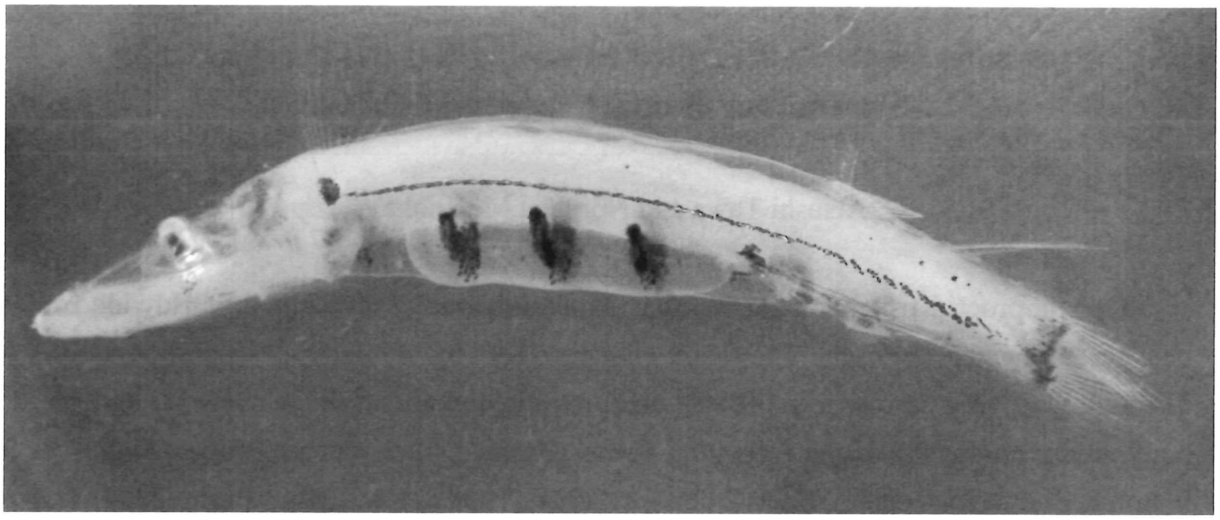

Fig. 1. *Dolichopteryx longipes* just after collection, 60.1 mm SL, KH-07-02 leg.3 st. 125, (14°-35.97'N, 142°-29.95'E), ORI-BF net (net depth 500 m to surface).

Table 1. Opisthoproctid fishes sorted out during KH-07-02 cruise

Leg.	St.	Date	Taxon	Standard length (mm)
Leg.1	S-57	070813	*Dolichopteryx longipes*	64 (broken)*
	10	070815	*Dolichopteryx longipes*	52.9*
	11	070815	*Dolichopteryx longipes*	44.8*
	20	070816	*Dolichopteryx longipes*	40.8
	23	070817	*Dolichopteryx longipes*	53.2
	37	070816	*Dolichopteryx longipes*	14.5*
	45	070818	*Dolichopteryx longipes*	35.1
Leg. 3	75	070907	*Dolichopteryx longipes*	76.3
	77	070907	*Dolichopteryx longipes*	47.2
	78	070907	*Dolichopteryx* sp.	37.7
	105	070910	*Dolichopteryx binocularis*	43.5
	107	070910	*Dolichopteryx longipes*	35.4*
	122	070912	*Dolichopteryx* sp.	30.9
	125	070912	*Dolichopteryx longipes*	60.1
	127	070912	*Dolichopteryx longipes*	64.7
	149	070914	*Opisthoproctus soleatus*	37.0

Opisthoproctid fishes were not collected by IKMT net (mesh size 5.5 mm).

*fixation in 99% ethanol.

Dolichopteryx sp.

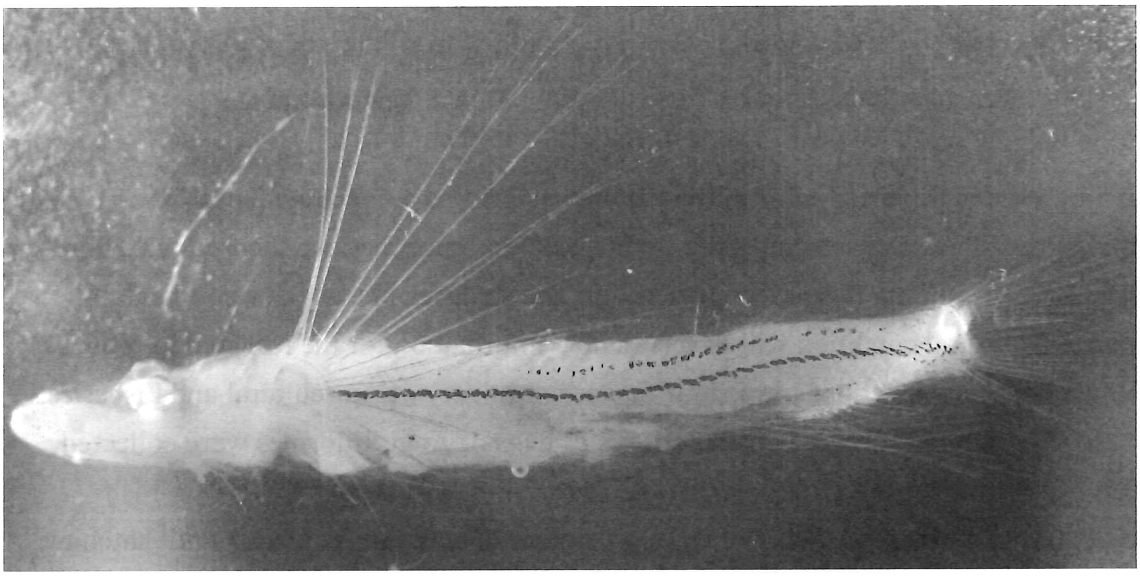

Fig. 2. *Dolichopteryx* sp. just after collection, 37.7 mm SL, KH-07-2 leg.3 st. 78 (13°-51.08'N, 143°-00.05'E), ORI-BF net (net depth 500 m to surface).

Counts. D 11; A 11; P1 15; P2 10; C 10+9; BR 2; Myomeres 41.

Body proportions (% SL). HL: 30.2, S-D: 78.0, S-A: 82.2, S-P1 30.5; S-P2: 57.3, S-Anus: 67.1, S-Adipose: 82.0

Distinctive characters. Body elongate; internal organ being enclosed by peritoneum and skin; 2 branchiostigal rays; eyes tubular, directed anterodorsally; origin of anal fin located under the dorsal fin base; pectoral and pelvic fins elongate (43.8% and 44.3 %SL, respectively); adipose fin present; anus before origin of dorsal fin base; 41 myomeres.

Remarks. Seven genera, (*Dolichopteryx*, *Bathylychnops*, *Ioichthys*, *Rhynchohyalus*, *Winteria*, *Macropinna*, and *Opisthoproctus* are included in the Opisthoproctidae. Of them, only *Dolichopteryx* has the combination of elongate body, internal organ being enclosed by peritoneum and skin, and 2 branchiostigal rays. Seven species, *Dolichopteryx anascopa*, *D. binocularis*, *D. longipes*, *D. parini*, *D. trunovi*, *D. rostrata*, and *D. minuscula* are currently considered as valid. The present specimen is similar to *D. anascopa* in having tubular eyes, origin of anal fin under the dorsal fin base, and elongate pectoral and pelvic fin rays. However, adipose fin is not figured in the original description of *D. anascopa* by Brauer (1901). Because *D. anascopa* is rarely collected, its morphological characters are not clear. We should reexamine type specimen of *D. anascopa* for the identification of the present specimen.

Eggs which are morphologically resembled eel egg Collected During the KH-07-2 Leg3 Cruise

Ryusuke Sudo, Atsushi Tawa, Takaaki Tamai, Yuzuru Suzuki

Finding eggs of Japanese eel, Anguilla japonica, must be a direct evidence for determination of the exact spawning site of this species. Since that, we focused our effort to collect eel eggs, during this cruise. In addition, the analyses of early development of this species in natural condition will gave valuable information for the research to produce the eel, which is now a national project of Japanese Ministry of Agricultural and Fisheries.

Total 96 eggs which showed characteristics of eggs of Anguilliformes were collected between 4 and 14 September 2007 during the KH-07-2 Leg3 Cruise by ORI-Big-Fish trawl with 0.5 mm net mesh. Some of the eggs similar to eel were incubated until hatching to analyze the early development. All the specimens were preserved in 99.5% Ethanol immediately. Three eggs No.21, 24, and 25 were carried out Real Time PCR. But unfortunately, these were not eel eggs. Other samples will be needed to DNA sequence analysis in the laboratory.

Table 1 List of eggs collected during the KH-07-2 Leg3 Cruise

No.	Date	St.	Diameter (mm)	Inc	Preserve	Note
1	4-Sep	58		o	Ethanol	
2	4-Sep	58		o	Ethanol	
3	4-Sep	59		o	Ethanol	
4	6-Sep	65		o	Ethanol	
5	6-Sep	66		o	Ethanol	
6	7-Sep	71		o	Ethanol	
7	7-Sep	74	2	-	Ethanol	
8	-	-	-	-	-	
9	7-Sep	75		o	Ethanol	
10	7-Sep	76	1.3	o	Ethanol	
11	7-Sep	77	2.2	o	Ethanol	
12	7-Sep	79	2	o	Ethanol	
13	7-Sep	79	2	o	Ethanol	
14	7-Sep	80		-	Ethanol	
15	8-Sep	81	1.6	-	Ethanol	Need Seqence
16	8-Sep	82		o	Ethanol	
17	8-Sep	83	2	-	Ethanol	Need Seqence
18	8-Sep	84	2.2	o	Ethanol	
19	8-Sep	85	1.3	o	Ethanol	Need Seqence
20	8-Sep	85	1.3	o	Ethanol	Need Seqence
21	8-Sep	85	1.3	o	Ethanol	Real Time PCR
22	8-Sep	85	1.3	o	Ethanol	Need Seqence

23	8-Sep	85	1.3	o	Ethanol	Need Seqence
24	8-Sep	85	1.3	o	Ethanol	Real Time PCR
25	8-Sep	85	1.3	-	Ethanol	Real Time PCR
26	8-Sep	85	1.3	-	Ethanol	
27	8-Sep	85	1.3	-	Ethanol	
28	8-Sep	85	1.3	-	Formalin	
29	8-Sep	85	1.3	-	Formalin	
30	8-Sep	85	1.3	-	Formalin	
31	8-Sep	86	1.5	o	Ethanol	
32	8-Sep	87	2	-	Ethanol	
33	8-Sep	87	2	-	Ethanol	
34	8-Sep	87	2	o	Ethanol	
35	8-Sep	88	2	-	Ethanol	Need Seqence
36	8-Sep	89	2.2	-	Ethanol	Need Seqence
37	9-Sep	90		o	Ethanol	
38	9-Sep	96	2.5	-	Ethanol	
39	9-Sep	100	0.8	o	Ethanol	
40	10-Sep	101	1.8	-	Ethanol	
41	10-Sep	103	2.2	o	Ethanol	Need Seqence
42	10-Sep	104	2.2	o	Ethanol	Need Seqence
43	10-Sep	105	2	-	Ethanol	
44	10-Sep	105	2	-	Ethanol	
45	10-Sep	106	2	-	Ethanol	
46	10-Sep	106	2	-	Ethanol	
47	10-Sep	108	2	-	Ethanol	
48	10-Sep	108	2	-	Ethanol	
49	10-Sep	108	2	-	Ethanol	
50	10-Sep	110	2	-	Ethanol	
51	11-Sep	114	1.3	-	Ethanol	Need Seqence
52	11-Sep	114	2	-	Ethanol	
53	11-Sep	116		-	Ethanol	
54	11-Sep	117	2.2	-	Ethanol	
55	11-Sep	119	2.5	-	Ethanol	
56	11-Sep	120	2.3	-	Ethanol	Need Seqence
57	11-Sep	121	1.8	-	Ethanol	
58	12-Sep	122	2	-	Ethanol	
59	12-Sep	123	2	-	Ethanol	
60	12-Sep	123	2	-	Ethanol	
61	12-Sep	123	2	-	Ethanol	
62	12-Sep	123	2	-	Ethanol	
63	12-Sep	123	2	-	Ethanol	
64	12-Sep	123	2	-	Ethanol	
65	12-Sep	124	2	-	Ethanol	
66	12-Sep	124	2	-	Ethanol	
67	12-Sep	129	2	o	Ethanol	
68	12-Sep	130	1.8	-	Ethanol	
69	12-Sep	131	1.8	-	Ethanol	
70	12-Sep	131	1.8	-	Ethanol	
71	13-Sep	132	1.8	-	Ethanol	

72	13-Sep	133	2	-	Ethanol	
73	13-Sep	135	1.8	-	Ethanol	
74	13-Sep	136	0.8	-	Ethanol	
75	13-Sep	136	0.8	-	Ethanol	
76	13-Sep	136	0.8	-	Ethanol	
77	13-Sep	136	0.8	-	Ethanol	
78	13-Sep	136	0.8	-	Ethanol	
79	13-Sep	136	0.8	-	Ethanol	
80	13-Sep	136	1.8	-	Ethanol	
81	13-Sep	139		-	Ethanol	
82	13-Sep	140	2.2	-	Ethanol	
83	13-Sep	140	1	-	Ethanol	
84	13-Sep	142	2.2	-	Ethanol	
85	14-Sep	146	3	o	Ethanol	
86	14-Sep	146	2	-	Ethanol	
87	14-Sep	146	2.3	-	Ethanol	
88	14-Sep	147	1.8	o	Ethanol	
89	14-Sep	147	1.8	o	Ethanol	
90	14-Sep	147	1.8	o	Ethanol	
91	14-Sep	147	1.3	o	Ethanol	
92	14-Sep	149	1.3	-	Ethanol	
93	14-Sep	153	1.8	-	Ethanol	
94	14-Sep	153	1.8	-	Ethanol	
95	14-Sep	153	1.8	-	Ethanol	
96	14-Sep	154	2	-	Ethanol	

Acoustic surveys of three seamounts of the West Marina Ridge

Tadashi Inagaki, Michael J. Miller, Akira Shinoda, Kazuki Yokouchi
and Katsumi Tsukamoto

During the KH-07-2 cruise of the R/V Hakuho Maru acoustic surveys were used to search for possible aggregations of spawning eels around 3 seamounts of the West Mariana Ridge. In association with this effort, acoustic data was recorded using scientific ecosounders at frequencies of 38, 70, 120, and 200 kHz, and acoustic targets were observed using the onboard ecosounder of Hakuho Maru (100 kHz) with their positions in relation to the seamount topography being charted. There were 2 general objectives of this effort, which were to note the locations of possible eel-like acoustic targets using the onboard ecosounder, and to more generally study the scattering volume of organisms around the seamounts in comparison to the open ocean environment in adjacent areas to determine if there is a greater degree of biological structure near seamounts than in the open ocean.

When Hakuho Maru approached the upper areas of the 3 seamounts many acoustic targets were observed in the 20 – 300 m range in some areas around the seamounts. For example, at the Pathfinder seamount in the north, dense aggregations of targets were observed from 130 to 200 m that could have been crustaceans or small fishes (Fig. 1A), but smaller more distinct targets were also seen. Around the upper zones of the Arakane and Suruga seamounts, many individual targets and larger patches that could be schools of fishes were observed (Fig. 1B, C). The distribution of these acoustic targets was not uniform around the seamounts however, suggesting that fishes were aggregating in certain regions depending on the current patterns, or the distribution of prey species.

During the KH-07-2 cruise, 124 data entries related to acoustic targets were made at the Pathfinder seamount, 60 at Arakane, and 191 were made the Suruga seamount where much of the focus of the survey was focused as a possible spawning area of the Japanese eel. These targets had a variety of shapes and sizes, and may have represented a wide range of fish species. However, the discrimination of different species using acoustic data is a complex process and requires detailed analysis of the data using different frequencies that are compared to simultaneous catch data from trawling (Horne, 2000; McKelvey and Wilson, 2006). Therefore, we could not determine if any of the targets observed were eels, or which type of other fishes they may have been.

The results of these surveys clearly suggest that the amount of large acoustic targets that may represent schools of fish, were much more common near the upper regions of the seamounts. The collection of a variety of predatory fishes during this and previous cruises suggest that many of these targets may have been predatory fishes that feed on small fishes and crustaceans that live in association with the seamounts or pass by it in the flow of currents. Seamounts may produce upwelling that could increase primary production in their vicinity, or they may disrupt the normal vertical migration of mesopelagic fishes and crustaceans, which could make them more vulnerable to predation by predators that may accumulate at seamounts.

Analysis of the scientific ecosounder data will attempt to evaluate if the scattering volume of acoustic targets is greater around the seamounts than in the nearby open ocean habitats. Some species of mesopelagic fishes or crustaceans have been implicated to remain near seamounts, and clearly coral reef or slope associated species, as well as migratory species of fishes are capable of remaining near the seamounts, which would result in a greater number of acoustic targets than in the open ocean. This research will be the first study on the biological structure of organisms assessed using hydroacoustics around very shallow seamounts whose summits are less than 100 m deep.

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McKelvey D. R., C. D. Wilson. 2006. Discriminant classification of fish and zooplankton backscattering at 38 and 120 kHz. Transactions of the American Fisheries Society 135: 488-499.

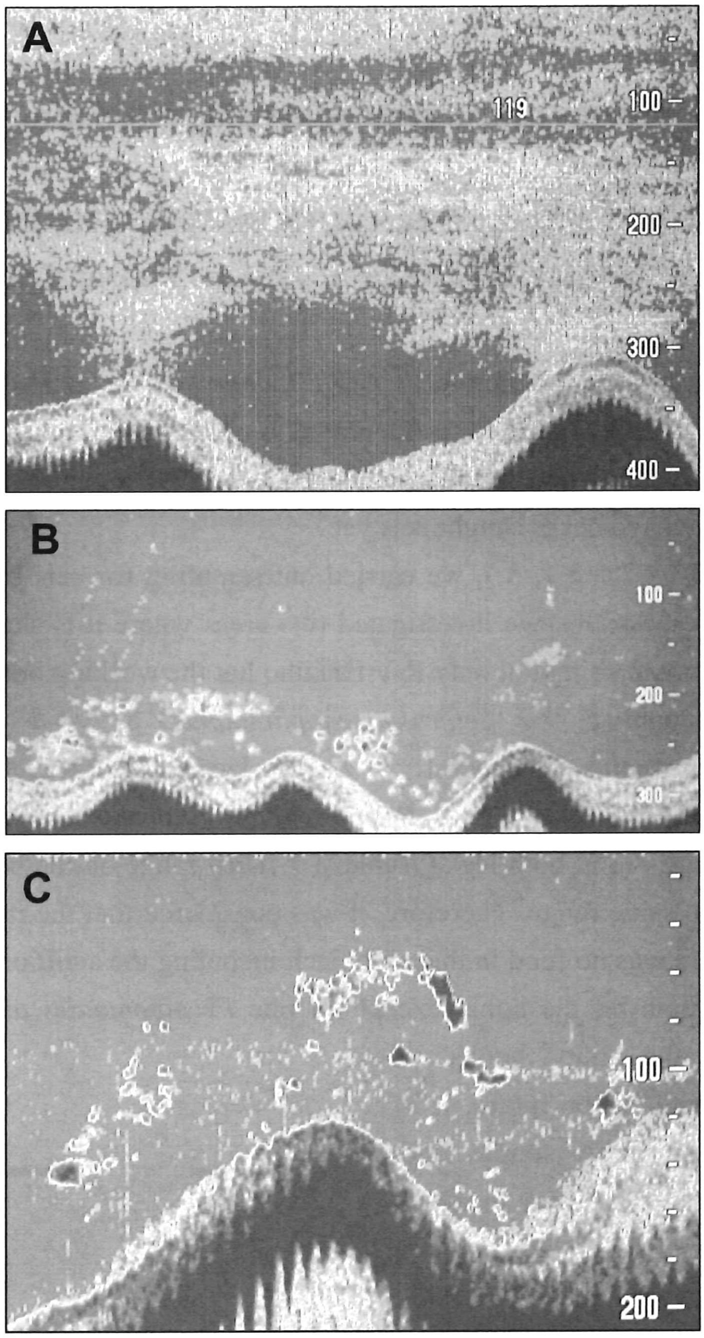

Figure 1. Acoustic scattering patterns at the Pathfinder seamount at night (A), at the Arakane seamount in daytime (B), and in daytime at the Suruga seamount (C) during the KH-07-2 cruise.

Observations near a seamount using a Hooking Net

Kei Zenimoto, Nobuto Fukuda, Akira Shinoda, Kazuki Yokouchi Seishi Hagihara, Naoki Yamaoka, Ryoichiro Manabe, Jun Aoyama and Katsumi Tsukamoto

The spawning area of the Japanese eel (*Anguilla japonica*) is located in near seamounts west of the Mariana Islands. Fishing was attempted to collect mature adult eels based on two hypothesises (seamount and new moon hypothesises) in 1998 and 2002 (Tsukamoto et al., 2003) . However, we have never caught eels yet .

In this cruise (KH-07-2 leg 1, 3), we carried out sampling for eels by " Hooking Net " (Fig. 1). In leg 3, espessially, we investigated two areas where it is shallower than 200 m near the Suruga seamount using not only R/V Hakuho but the working boat (Fig. 2).

As a result, we caught メアジ *Selar crumenophthalmus* × 8, カッポレ *Caranx lugabris* × 1, アカハタ *Epinephelus faciatus* × 1, バラハタ *Variola louti* × 1, キマダラヒメダイ *Pristipomoides auricillia* × 2, オオヒメ *Pristipomoides filamentosus* × 1 and シマチビキ *Pristipomoides zonatus* × 2 in both legs (Table. 1). They range on the bottom and adult eel may also be found in same range. Therefore, it was considered that the range of this method was reasonable. There was no food in these stomach including the adult or larvae of eel.

Because all of them bit the hook, except for one *Pristipomoides auricillia,* they have probably mistaken the shiny hooks or coating tubes for food. In the future, it is necessary to find a more simple and improved way and to devise how to avoid hooking the predatory fishes.

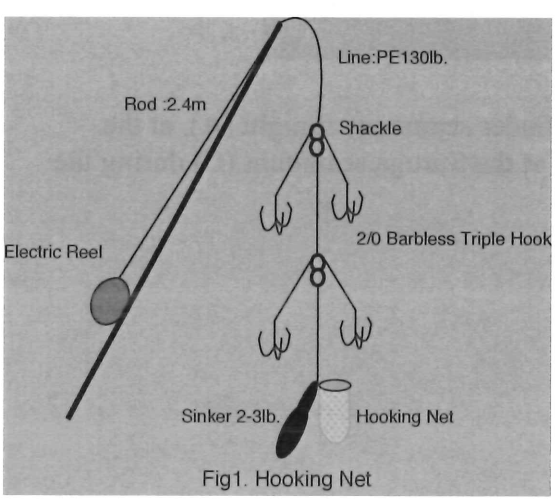

Fig1. Hooking Net

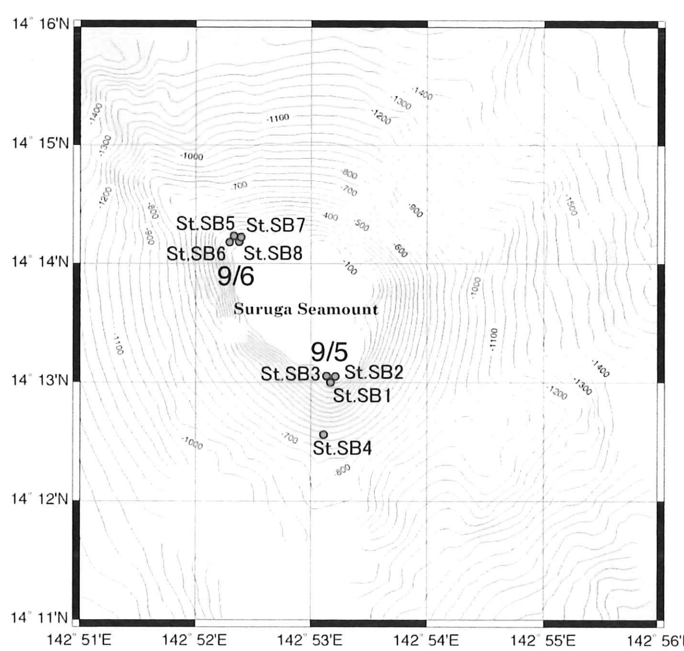

Fig.2 Survey area (Leg3)

	time	St.	latitude	longitude	depth	school of fish	result
70808	1:38	St.A2	15° 37'83	142° 45'16	303m	×	*Selar crumenophthalmus* ×2
70808	2:37	St.A3	15° 38'93	142° 45'56	307m	110m	*Selar crumenophthalmus* ×6
70905	12:45						Leave vessel
70905	13:40	St.SB1	14° 13'01	142° 53'16	×	×	×
70905	14:25	St.SB2	14° 13'05	142° 53'19	110m	×	Hit but get out (W.O.108m)
70905	14:40	St.SB3	14° 13'05	142° 53'13	110m	×	×
70905	14:53	St.SB4	14° 12'58	142° 53'09	120m	100m	Hit but get out (W.O.98m)
70905	15:20						Return to vessel
70906	8:30						Leave vessel
70906	×	St.SB5	14° 14'21	142° 52'36	250m	×	×
70906	×	St.SB6	14° 14'16	142° 52'32	170m	×	×
70906	×	St.SB7	14° 14'19	142° 52'42	×	×	Hit but get out (W.O.200m)
70906	×	St.SB8	14° 14'15	142° 52'40	180m	×	Hit but get out (W.O.164m)
70906	×	St.SB8	14° 14'15	142° 52'40	100m	×	*Epinephelus faciatus* ×1(W.O.75m)
70906	×	St.SB8	14° 14'15	142° 52'40	×	×	Variola louti ×1
70906	×	St.SB8	14° 14'15	142° 52'40	93m	×	*Caranx lugabris* ×1(W.O.100m)
70906	×	St.SB8	14° 14'15	142° 52'40	120m	×	*Pristipomoides auricillia* ×1
70906	×	St.SB8	14° 14'15	142° 52'40	200m	×	*Pristipomoides zonatus* ×1(W.O.209m)
70906	×	St.SB8	14° 14'15	142° 52'40	210m	×	Hit but get out (W.O.235m)
70906	×	St.SB8	14° 14'15	142° 52'40	200m	×	*Pristipomoides filamentosus* ×1(W.O.215m)
70906	×	St.SB8	14° 14'15	142° 52'40	210m	×	*Pristipomoides zonatus* ×1(W.O.265m)
70906	×	St.SB8	14° 14'15	142° 52'40	220m	×	*Pristipomoides auricillia* ×1
70906	11:40						Return to vessel

St.A=Arakane, SB=Suruga Boat

Use of a large mesh size IKMT net for sampling of spawning Japanese eel around seamounts

Akira Shinoda, Jun Aoyama and Katsumi Tsukamoto

In order to collect eels within spawning aggregations of the Japanese eel, *Anguilla japonica*, IKMT tows using a large mesh size were carried out between 3 to 19 August during Leg 1 of the KH-07-2 cruise. The IKMT net had an 8.7 m^2 mouth opening and 5.5 mm mesh. An echosounder was used to search for possible aggregations of spawning *A. japonica* (see Inagaki et al. in this report), and the trawl was fished in horizontal tows at a faster speed of 4 kt to attempt to catch the acoustic targets that were observed. However, only small fishes and large crustaceans were collected with this method. Thereafter, 3-mile square grids were set around the seamounts, and the trawl was fished in step tows. A total of 44 tows were made around the three seamounts (Pathfinder: 4 tows, Arakane: 5 tows, Suruga: 35 tows), but no eels or large fish were collected.

Genetic species identification of *Anguilla japonica* preleptocephali using realtime PCR sequence detection system: matching with morphological characteristics and prevention of contamination

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Noritaka Mochioka and Tatsuki Yoshinaga[3]

1. Background

Onboard genetic species identification for eggs and larva (leptocephali) using a realtime PCR *Anguilla japonica* sequence detection system (Aj-SDS) has been employed since 2004 (KH-04-2, KH-05-1, KH-06-2 and KH-07-2), and contributed to a discovery of pre-leptocephali of the species in 2005 (Tsukamoto, 2006). This technique is especially useful for the individuals at very early developmental stages or damaged during net-sampling because the morphological key characters for species identification are not often available for such specimens. Target species (*A. japonica*) can be determined by a species-specific DNA nucleotide sequences in a mitochondrial DNA (mtDNA) 16S rRNA gene, and detected by a combination of specifically-designed PCR primers and fluorescent-labeled TaqMan probe (Watanabe et al, 2004). The Aj-SDS has been developed by comparing the DNA nucleotide sequences of anguillid species (Aoyama et al, 2001; Minegishi et al, 2005), and confirmed to distinguish *A. japonica* from the other congeners such as *A. marmorata* and *A. bicolor pacifica* (Watanabe et al, 2004). Minegishi et al (in prep) has refined the method to accurately identify eggs and pre-leptocephali (defined as the stage before eye pigmentation with unfixed total myomere number, TM), and further proved that the method is effective for *A. japonica* specimens collected from various locations during more than 10 years. Because the DNA nucleotide sequence is more conservative between closely-related species, the method by Watanabe et al (2004) and Minegishi et al (in prep) seems enough to be effective to identify A. *japonica* specimens onboard.

During KH-05-1 cruise, however, a pseudo-positive problem has emerged that the Aj-SDS has miss-identified *Serrivomer* sp. as *A. japonica*. The DNA nucleotide sequence of the specimen, determined after the cruise, has been found to be obviously different from that of *A. japonica*, and the source of the miss-identification has not yet been clear. The genus *Serrivomer* may be one of the most difficult groups to be distinguished from *Anguilla* by the currently available information and method. The species of this genus widely distributes in the Pacific and Atlantic oceans, and s huge number of leptocephali have been collected. On the other hand, the adults specimens are rare yet and their ecology is still mysterious. The range of TM, a key morphological character for species identification, of the genus *Serrivomer* overlaps with that of *A. japonica* at the preleptocephalus stage (Miller and Tsukamoto, 2004), and the genus has been suggested to be phylogenetically closely-related to *Anguilla* among anguilliform fishes, inferred from the complete mtDNA nucleotide sequence (Inoue et al, 2004). There may be two possible sources causing a miss-identification: (1) an existence of pseudo-gene in the *Serrivomer* genome, and (2) a cross contamination between *Serrivomer* and *A. japonica* samples. Except a few examples of heteroplasmy such as in Japanese flounder (Shigenobu et al, 2005), the mtDNA is homogeneous in an individual (homoplasmy) and thus the gene in the mtDNA do not have allele. This feature has been an advantage of the mtDNA gene to be used as a genetic marker for species identification. It has been known, however, that nuclear genome involves the DNA nucleotide sequences which are quite similar with those of the mtDNA. Such region might have incorporated from the mtDNA probably due to the transposon activity in the ancestor's genome, and has been remained with no function (the sequence sometimes contains non-synonymous substitution, and called pseudo-gene). Functional and pseudo-genes can be distinguished by determining their sequences. However, the PCR may amplify both regions, or pseudo-gene only if the specimen's genome does not contain the target (functional) gene sequence, leading to the miss-identification. Despite of a big effort so far made to collect leptocephali during some decades, there should remain a huge number of species which are new to science and might be, unfortunately, miss-identified as target species (*A. japonica*) with currently available information and technique. The more the sampling gear getting improved, the more the catch of trouble maker will increase. Accumulation of information and improvement of the identification method are necessary to reduce the risk of miss-identification step-by-step.

The cross contamination is probably the most unwanted artificial-error not only in the SDS but indeed in any PCR applications. Even in a stable and clean laboratory, the contamination can occur, for example, the PCR with a dinosaurs fossil (Woodward et al, 1994) was shortly later criticized that the contaminated human DNA was miss-amplified (Hedges et al, 1995). The SDS overcomes the PCR-carryover, the main source of contamination, by incorporating a DNA nuclease cleavages only PCR product (ABI). However, other sources of contamination, such as an aerosol and polluted equipments, still remain in the system and can cause the cross contamination among samples. Because the contamination is caused by human, all procedures must be operated with very careful attention to reduce the contamination risk as much as possible, with an effective negative control sample.

Thus the aim of this study is to establish a reliable genetic species identification method of *A. japonica* onboard, and examined (1) the matching of the results from genetic and morphological identifications, and (2) the effective procedure to prevent a contamination risk. Further, as a trial, (3) we have tentatively identified other anguillid species such as *A. marmorata* and *A. bicolor pacifica*, appeared around *A. japonica* spawning ground, from the results of allelic discrimination (AD) analysis developed by Minegishi et al (in prep). The samples showing Aj-SDS positive are subjected to the post-hoc AD analysis to reduce the risk of miss-identification by the SDS. The principal of the AD analysis is basically similar with that of the SDS, except two probes respectively specific to *A. japonica* and *Serrivomer* sp. are used in the AD analysis (single probe in the SDS) (Minegishi et al, in prep). Empirical criteria among three anguillid species (*A. japonica*, *A. marmorata* and *A. bicolor pacifica*) was determined on the basis of variation in their DNA nucleotide sequences (AB038556, AP007242 and AP007236, respectively), and results from leptocephali specimens with morphological characters enough to be identified as a certain species.

2. Materials and methods

Leptocephali were collected by ORI BigFish Trawl with 0.5 mm mesh nets. After each tow, specimens were sorted fresh out of plankton samples, and morphological characters were measured and photographed according to Miller and Tsukamoto (2004). During the procedure, specimens were preserved in ice-water bath to minimize degradation of nucleic acid.

Total 93 specimens have been sorted out during the cruise (75 and 18 in leg 1 and 3, respectively), and all specimens have been analyzed by the Aj-SDS and subsequent AD analyses onboard, as to be potentially *A. japonica* inferred from morphological characters (Table 1). Posterior body (tail) was excised, and homogenized in 50 μL of 5% (w/v) Chelex-resin solution (Bio-Rad) with disposable plastic pestle. Remaining anterior part was preserved in 99.5% (v/v) ethanol for later otolith aging analysis. The homogenized tissue was boiled at 95°C for 15 minutes to heat-denature proteins, and thus inactivate nucleases. Crude DNA fraction was separated by centrifugation at 2000 *g* for 1 minute with a small table-top centrifuge, and supernatant was used for the subsequent PCR. The Aj-SDS and AD analyses were carried out according to Minegishi et al (in prep). The procedures have been carried out by at least two researchers to prevent mistakes: one worked as a main operator (chiefly R.S.), and the others (E.S., M.K. or T.Y.) supported the main operator to handle samples and reagents. Given the risk of contamination from the aerosol and polluted equipments, the PCR tubes were sealed at every step and filtered tips were used throughout the analyses. In each assay, positive and negative (no template DNA control, NTC) controls were tested to confirm the success of reaction and absence of contamination, respectively.

3. Results and discussion

During the KH07-2 cruise, total 22 assays have been carried out on board (19 and 3 in leg 1 and 3, respectively). Preleptocephali with the TM of around 110 were selected by researchers with morphological identification skill (N.M., M.J.M., M.K.), and subjected to the Aj-SDS and AD analyses. Specimens with *A. japonica*-positive were found at the stations 3, 20 and 25 (Table 1). Those were at the preleptocephalus stage, and the TM had not yet been fixed. Some of those were broken during the collection, and counting the TM was not available. The identification will be confirmed by the DNA nucleotide sequencing after the cruise.

In this study, we have paid attention to prevent the contamination as much as possible. During the study, two artificial errors have occurred: (1) miss-handling of the sample (station 3), (2) and miss-judgement of the negative control (NTC) pattern (station 25). During the survey, as the SDS result obtained faster, determining the allocation of sampling effort will be easier. However, handling important samples and carrying out sensitive experiments onboard can heavily stress the operator, and resulted in simple mistakes. Therefore, the accuracy of the experiment should be at the most priority rather than obtaining the results faster. In this study, to relief the operator, experiments were carried out in an isolated laboratory in the vessel where the operator could proceed the experiment smoothly with technical support by another researcher.

Secondly, miss-judgement of the NTC occurred when the experiment was carried out with new lot of TaqMan probe. Because the NTC and some unknown samples showed weak but obvious signal in the Aj-SDS analysis, the assay was judged as contaminated and discarded by T.Y., even though the other samples showed strong positive signal, indicating that the specimens were possibly *A. japonica*. Later analysis has revealed that only one lot of probe, used in the miss-judged assay, shows ambiguous pattern, and makes difficult to decide whether the assay has been appropriately completed or not. Especially in the case which some samples show positive signal, the decision becomes more difficult to avoid a risk of pseudo-positive, as has been occurred in 2005. The pseudo-positive should be avoided rather than the pseudo-negative because the meaningless sampling effort will be brought as a result. To avoid these problems, quality control of reagents should be made carefully in addition to understand the property (stability) of chemicals used in the assay.

In this study, we have tentatively identified the other anguillid species of *A. marmorata* and *A. bicolor*. Discussion mentioned here should be paid attention because the identification is based on morphological characters of pre-leptocephali specimens and empirically determined criteria in the AD analysis. The AD analysis uses two specific probes against 70 and 69 bases in the mtDNA 16S rRNA gene of *A. japonica* and

Serrivomer sp., respectively. The DNA nucleotide sequence of corresponding region has some variations in *A. marmorata* and *A. bicolor pacifica*. Because the hybridization of probe can occur against the region with some nucleotide sequence variations, at lower efficiency, weak signal is observed when applied to the other closely-related species. In this study, we compared the amount of probe hybridization among pre-leptocephali specimens with large one with obvious morphological characters to be identified at species level. This trial allows us to empirically determine the signal range of *A. marmorata* and *A. bicolor* in the AD analysis. To obtain more reliable result onboard, developing the specific probes for the other anguillid species will be important for the next adventure.

4. Additional note

The DNA nucleotide sequencing has been carried out for 16 selected specimens after Leg. 1 of the KH07-2. Six of 8 specimens identified as *A. japonica* by the SDS and AD analyses were supported to be *A. japonica*. However, other 2 specimens were found to be *A. marmorata* and *Serrivomer sp.*, respectively (pseudo-positive). In addition, 1 specimen identified as non-*Anguilla* was *A. japonica* (pseudo-negative). Possible cause of these failures will be investigated after the cruise, and the species identification method will be improved.

Acknowledgment

We would like to thank Dr Yuki Minegishi (Montpellier Univ, France) who has been a core member of genetic species identification project, and enthusiastic to support this cruise.

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Table 1 List and Result of all samples during KH-07-2 Leg1 Cruise

Date	Assay	Method	Ind#	St	NTC	Positve	Result Aj-SDS	Result AD	Note
2007/8/5	1	TM/SYBR/AD			—	+			PCR check
2007/8/5	2	TM/SYBR/AD			+	+			PCR check
2007/8/6	3	TM/SYBR			+	+			PCR check
2007/8/6	4	SYBR			+	+			PCR check
2007/8/7	5	SYBR			+	+			PCR check
2007/8/9	6	TM/AD	No.22	S13	—	+	—	—	
			No.23	S14			—	—	
2007/8/11	7	TM/AD	No.64	S23	—	+	—	seri	
			No.65	S23			—	seri	
			No.67	S23			—	seri	
			No.72	S23			—	seri	
			egg1	—			—	seri	
			egg2	—			—	—	
			egg3	—			—	—	
			Back	—			—	—	
2007/8/14	8	TM/AD	No.180	3	—	+	—	seri	
			No.181	3			+	jap	
2007/8/14	9	AD	No.180	3	—	+		seri	
			No.181	3				jap	
2007/8/15	10	TM/AD	egg st.9	9	—	+	—	—	
			No.188	6			—	seri	
			No.193	8			—	seri	
			No.203	11			—	seri	
2007/8/16	11	TM/AD	No.33	A15	—	+	-	-	
			No.204	11			-	Ang?	
			No.227	19			-	Ang?	
			No.228	19			-	Ang?	
2007/8/16	12	TM/AD	No.229	20	-	+	-	Ang?	
			No.230	20			-	Ang?	
			No.231	20			-	Ang?	
			No.232	20			-	Ang?	
			No.233	20			-	Ang?	
			No.234	20			-	Ang?	
			No.235	20			-	Ang?	
			No.236	20			-	Ang?	
			No.237	20			-	Ang?	
			No.238	20			-	seri	
			No.239	20			-	seri	
			No.241	20			-	Ang?	
			No.242	20			+	-	handling miss
			No.243	20			+	Ang?	handling

									miss
			No.244	20			-	Ang?	
			No.245	20			-	seri	
			No.246	20			-	Ang?	
2007/8/16	13	TM/AD	No.242	20	−	+	+	jap	
			No.243	20			-	Ang?	
			No.252	34			-	Ang?	
			No.253	34			-	Ang?	
			egg stS57	S57			-	-	
			egg st34	34			-	-	
2007/8/16	14	TM/AD	No.255	35	−	+	-	Ang?	
			No.256	35			-	Ang?	
			No.257	35			-	Ang?	
			No.258	35			-	Ang?	
			No.259	35			-	Ang?	
			No.260	35			-	seri	
			No.261	35			-	seri	
			No.266	37			-	seri	
2007/8/17	15	TM/AD	No.33	A15	−	+	-	Ang?	
			No.187	5			-	-	
			No.197	9			-	-	
			No.254	35			-	Ang?	
			No.268	37			-	Ang?	
			No.269	37			-	Ang?	
			No.274	39			-	seri	
			egg st39	39			-	-	
2007/8/17	16	TM/AD	No.317	31	−	+	-	Ang?	
			No.318	31			-	seri	
			No.319	31			-	seri	
			No.320	31			+	jap	
			No.321	31			+	jap	
			No.322	31			+	jap	
			No.323	31			+	jap	
			No.324	31			+	jap	
			No.325	31			+	jap	
			No.326	31			-	seri	
			No.327	31	−	+	-	seri	
	17	TM	No.242	20			+		retry
			No.320	31			+		
			No.322	31			+		
			No.324	31			+		
	18	TM	-		−	+			Probe check
	19	TM/AD	egg st.45	45	−	+	-	seri	
			No.349	25			+	jap	
			No.350	25			+	jap	
			No.357	25			+	jap	
			No.362	25			+	jap	

			No.363	25			+	Ang?	
			No.385	28			-	seri	
			No.387	45			-	seri	

Table2 List and Result of all samples during KH-07-2 Leg3 Cruise

Date	Assay	Method	Ind#	St	NTC	Positve	Result Aj-SDS	Result AD
2007/9/9	1	TM/AD	egg 21	85	—	+	—	-
			egg 24	85			—	-
			egg 25	85			—	-
2007/9/11	2	TM/AD	No.710	104	—	+	—	-
			No.712	104			—	seri
			No.715	105			—	seri
			No.720	106			—	seri
			No.722	106			—	seri
			No.757	110			—	-
			No.761	110			—	seri
			No.762	110			—	seri
			No.777	111			—	seri
			No.800	115			—	seri
2007/9/14	3	TM/AD	No.1172	144			—	seri
			No.1183	145			—	seri
			No.1194	147			—	seri
			No.1195	147			—	seri
			No.1197	149			—	seri

Studies on diet environment for the Japanese eel larvae by using stable isotope analysis

Sachie Miyazaki and Takashi Kitagawa

Two day-old pre-reptocephali of Japanese eel (*Anguilla japonica*) were collected in waters around the West Mariana Ridge in 2005, and the spawning area of the Japanese eel was fixed in waters of 14−17 °N and 142−143 °E (Tsukamoto, 2006). Also, great numbers of leptocdephali were caught in previous research cruises in the south of the salinity front of the spawning area (Kimura et al. 1994). Additionally, distribution of particular organic matter (POM) and zooplankton in the south of the front differed from the north (Kimura and Tsukamoto 2006), suggesting that the difference plays an important role of eel larvae survival. Therefore our main objective is to clarify the biological difference affecting on the survival by the stable isotope analyses.

In this cruise, KH-07-2_Leg 1 and 3, zooplankton samples for the analysis were collected near the spawning area by oblique tows of an ORI ring net with 3 m in diameter and 0.5 mm in mesh size. Water samples were collected from depths of 50, 100, 150, and 200 m at seven stations of 140 °E and five stations near the Suruga seamount. In order to clarify to species composition, zooplankton samples were also collected by vertical tows of a NORPAC twin net (North Pacific Standard Net, mesh sizes of 0.10 and 0.33 mm) at seven stations of 140 °E.

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Estimation of possible school size of spawning Japanese eels *A. japonica*

Kunihiro Watanabe[1], Ryusuke Sudo[1], Keitaro Manabe[1] and Tatsuki Yoshinaga[2]

[Introduction]

Biological information about spawning females of the Japanese eel is needed for establishing their cultivating technique, in addition to the comprehensive understanding of the species' life history. Although we have so far attempted various methods such as fishing nets and hooking gear, adult eels have never been caught around the seamount in their western Pacific spawning site (Tsukamoto, 2006). The acoustic fish finder has been employed for attempting to locate school of eels. It is difficult, however, to distinguish eels from the other numerous schools of other species appearing around the seamounts, because characteristics for identification of the eels are very limited. Thus we have estimated the numbers and spatial size of possible schools of spawning eels with currently available information to provide some information that may be useful for acoustic fish finding surveys of the Japanese eel.

[Materials and Methods]

Yoshizawa (2006) has examined the variation in the DNA nucleotide sequence of a partial mtDNA control region of 86 preleptocephali (2-5 days old) caught by a single tow during the KH-05-1 cruise and found that most preleptocephali examined had a unique haplotype, indicating that they were spawned by different females. Our estimation is based on the assumption that as greater numbers adults reproduce, the uniqueness of young juveniles' haplotype will increase. Accordingly, to obtain a reasonable number of females that produced the specimens examined by Yoshizawa (2006), we calculated the probabilities (P_{80}) that 80 specimens, derived from a various number of mothers, exhibit a unique mtDNA haplotype with the following equation (1).

$$P_n = P_{n-1} \times (B \times C - (n-1) \times C) \ / \ (B \times C - (n-1)), \qquad P_1 = 1 \quad \ldots(1)$$

In this equation, *B* represents the number of spawning females, ranging from 100 to 1,000,000, and the number of eggs spawned by one female was assumed to be 1,000,000 (*C*).

Then the spatial sizes of the schools were estimated with the assumption that females distribute spatially evenly by maintaining the constant distance (D cm) each other, ranging from 30 to 100 cm (Fig. 1). The length of an edge (*L* m) of the school was calculated by the equation (2), if the school was assumed to be a cube.

$$L = (B \times D^2 \times (50 + D))^{1/3}) / 10^2 \quad \ldots(2)$$

[Results]

Estimated probabilities (P_{80}) exhibited a sigmoid curve (Fig. 2). P_{80} were 0.039, 0.530 and 0.969 when the numbers of spawning females were 1000, 5000 and 100,000 individuals, respectively. This indicated that it would be unlikely that all the 80 leptocephalus caught by a single tow would have a unique haplotype when the number of spawning females was less than 1,000 individuals.

Calculated lengths of an edge (L m) of the school were proportional to the distance between each individual (Fig. 3). L was almost stable at 10 to 20 m regardless of the distance between individuals when the number of spawning females was assumed to be 1,000 individuals.

[Discussion]

In this study, to simplify the calculation we have estimated the population size of the spawning females with the assumption that all the juveniles in a single tow were all unique haplotypes. In the real data, however, Yoshizawa (2006) has found that 9 out of 86 preleptocephali had the same haplotype as each other. According to the result of this study, two randomly selected individuals would not have the same haplotype when the number of spawning females was more than 100,000 (Fig. 2). Thus the reasonable number of females composing a single school, analyzed by Yoshizawa (2006), would be less than 100,000. Estimated lengths of a school edge were less than 60 m when the number of females was 100,000 (Fig. 3). This indicates that the school of spawning eels will not exceed 60 m of length in a cubic form. Although males were not included in our estimation, sex ratio will not be so

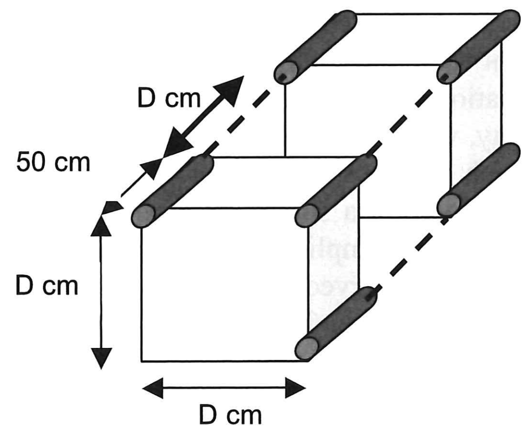

Fig.1. Spatial distribution model of spawning eels.

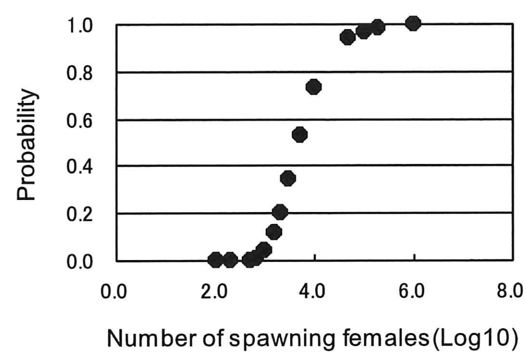

Fig.2. Probabilities that all preleptocephali exhibit a unique mtDNA haplotype.

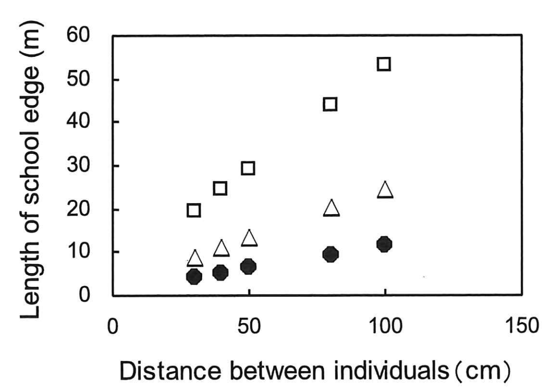

Fig. 3. Length of the eel spawning school. The number of spawning females assumed were □: 100,000, △: 10,000, ●:1,000.

skewed on the spawning ground. In the acoustic fish finding survey, we have targeted the schools that appeared as a strong signal on the display, and seemed possible to be caught by the available gears such as the IKMT net and hooking gear. However, our estimation predicts that schools of spawning eels would be only small dots on the display, which might have been neglected as just signal noise. Currently, it is difficult to catch such a small school after its position was recorded using the acoustic survey technique from a single research vessel that must reposition itself before deploying a trawl. New sampling gear and protocols, in addition to better identification abilities of the targets observed by acoustic surveys will important for improving the chances of catching spawning female eels.

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Ocean skater Halobates spp. (Hemiptera : Gerridae) collected during the Hakuho Maru cruise KH07-2 Leg. 3 and the preliminary study of reproductive organs of females

Terumi Ikawa, Mikio Sasaki and Wakana Taki

Introduction

Among more than one million species of insects only ocean skaters Halobates could successfully colonize in the high seas. Ocean skaters (H. micans Eschscholtz, H. sericeus Eschscholtz, H. sobrinus White, H. germanus White and H. splendens Witlaczil) are distributed in warm tropical or subtropical waters (Cheng 1985; Andersen and Cheng, 2004). They are wingless through all their life stages and live at the air-sea interface. Little is know how they meet, find mates and repeat generations on the open ocean where oceanic turbulence constantly acts on them to disperse to all directions. Our knowledge about their life history and reproduction are fragmental due to the difficulties in regular survey in the open ocean and in rearing them in the laboratory.

During the R/V Hakuho Maru cruise KH07-2 Leg. 3., we collected Halobates to study the distribution of Halobates, to describe the morphology of reproductive organs of females, and to find females' reproductive stages and ovipositional experiences.

Materials and Methods

Ocean skaters were collected at 22 stations in the area between latitudes ca. 13°N - 18°N and longitudes ca. 140°E – 143°E with a neuston net (40 x 100 cm in mouth opening and 450 μm mesh size) towed at the sea surface at approximately 2 – 3 knots for 10–35 min (Table 1). Halobates captured were sorted on board. A part of adult females were identified and dissected under microscope. The rest of females were stored in 1:1 physiological solution and ethanol for further investigation in laboratory. Male adults and nymphs were counted and preserved in 99% ethanol and will be identified in laboratory. The area towed was calculated by multiplying the width of the net opening by the distance towed. Densities of Halobates spp. were estimated by using the number of insects caught in the towed area.

Adult females of H. micans were dissected under microscope and the females' reproductive organs were observed. We tried to find if there are any features which would indicate ages and reproductive histories of females.

Results and Discussion

In Table1 we listed the date, sampling stations, towing conditions, surface temperatures, and numbers and estimated densities Halobates spp.

In all the tows, ocean skaters were collected. Most adult specimens were H. micans. Small numbers of H. sericeus and H. germanus were also captured. The estimated density of Halobates spp. in each station ranged from ca. 2000 to ca. 20000 individuals/km2. Assuming most of the specimens were H. micans, the densities obtained are comparable to those of H. micans in other regions (Cheng and Shulenberger, 1980; Ikawa et al., 2004, 2007). Identification of all the specimens will be carried out for further analysis.

Dissection of females revealed that H. micans has two lateral oviducts with four ovarioles. We could detect various stages of female ovarioles. As is shown in Fig.1, the immature stage (panel A), mature stage (panel B), senescent stage (panel C) were recognized. We also found yellow pigmentations in ovarioles, which may indicate the female to be parous. Similar pigmentations are known to be found in parous ovarioles in some coleopteran insects. These features of ovarioles would be useful to estimate age and reproductive history of females. So far, we did not detect any sperm in the gynatrial complex of females with mature eggs. Further investigation is under way.

Acknowledgement

We thank Professor K. Tsukamoto, the chief scientist of this cruise, for his warm encouragement and help, which enabled our research. We also thank Captain F. Inaba and the crew for their invaluable support for our sampling. We are greatly indebted to our fellow scientists and the crew of “four-eight watch” for their skillful support and joyful cooperation all through the sampling and research on board during this cruise.

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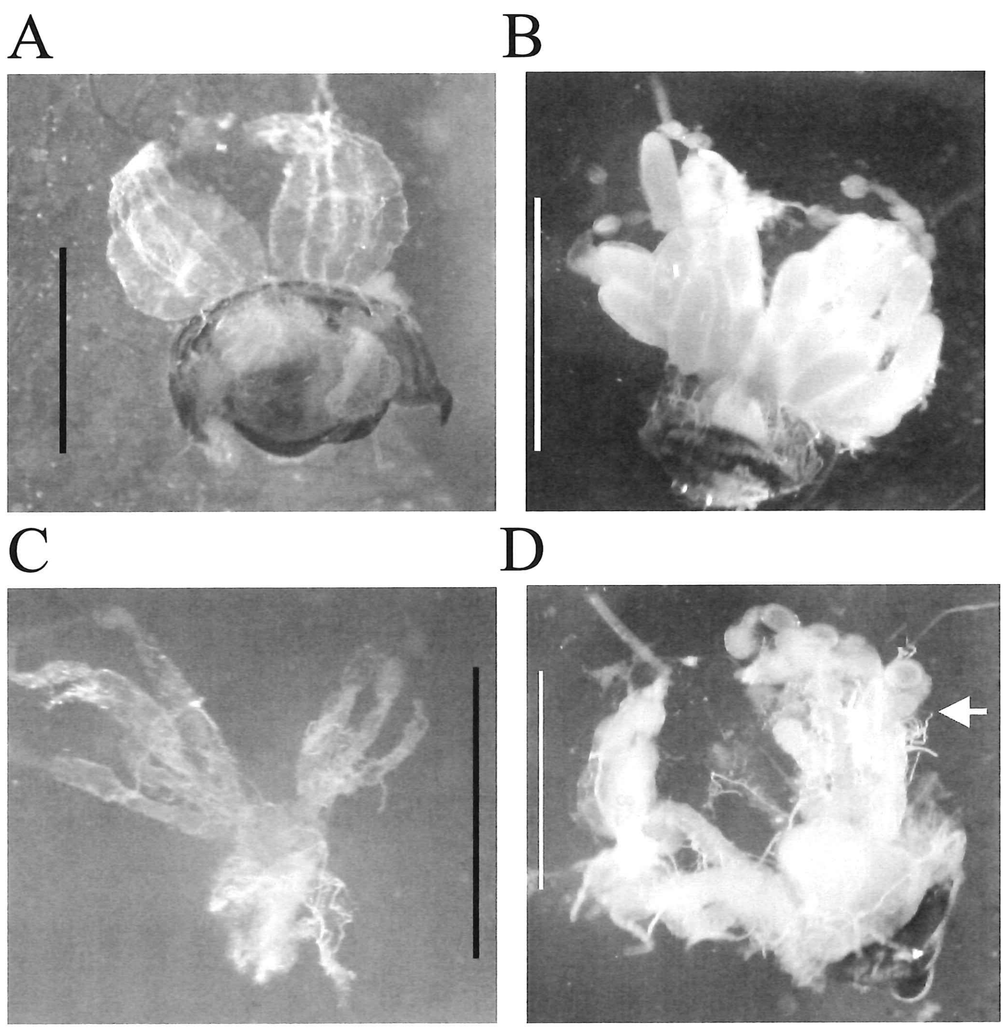

Fig. 1. Ovarioles of *H. micans*. A: Immature ovarioles with no eggs. B: Mature ovarioles with many immature and mature eggs. C: senescent ovarioles. D:Ovarioles with yellow pigmentation, which indicates the female to be parous. The bar in the picture indicates 1mm in A and D, and 2mm in B and C.

Table 1. List of date, location, towing conditions, surface temperature, and numbers and estimated densities of *Halobates* spp. collected.

Date	Station No.	Time	Latitude	longitude	Towing speed (kt)	Area Towed(m2)	Surface Temperature(˚)	No. *Halobates*spp. Collected	Estimated Density of *Halobates*spp.(/km2)
2007903	48	521	18 29.244N	140 00.883E	2.5	709	29.6	5	7052
2007903	49	919	17 59.682N	140 00.565E	2.7	1099	29.8	17	15469
2007903	51	1623	16 59.039N	139 58.759E	2.5	1691	32.1	14	8279
2007903	52	1926	16 30.377N	139 59.966E	2.3	1894	30.8	9	4752
2007903	53	2318	15 59.898N	139 59.841E	2.4	1840	30.3	20	10870
2007904	55	620	14 59.783N	139 59.794E	2.5	1854	29.8	37	19957
2007904	56	928	14 30.280N	139 59.739E	2.5	2199	32.0	27	12278
2007904	58	1654	13 29.699N	139 59.888E	2.5	2451	31.6	34	13872
2007904	59	2051	12 59.903N	140 00.071E	2.8	2230	30.5	25	11211
2007909	98	1741	13 51.282N	142 30.117E	2.1	1190	30.0	23	19328
2007910	102	441	13 51.189N	142 59.952E	2.4	1553	29.7	21	13522
2007910	105	1055	14 35.930N	142 59.733E	2.3	1442	29.9	11	7628
2007911	113	353	14 36.024N	142 30.114E	2.8	1451	28.9	6	4135
2007911	114	826	13 51.113N	142 59.961E	2.5	1424	29.7	3	2107
2007911	117	1514	14 35.847N	142 59.642E	2.6	1447	30.1	11	7602
2007912	124	552	14 21.287N	142 30.057E	2.2	1161	29.7	4	3445
2007912	126	1218	15 05.548N	141 45.005E	2.5	1438	29.6	4	2782
2007912	128	1626	14 36.086N	141 44.940E	2.5	1362	30.1	8	5874
2007913	134	512	14 21.455N	141 59.874E	1.9	1234	29.9	30	24311
2007913	137	1136	15 05.856N	142 00.076E	2.6	1594	29.5	37	23212
2007913	139	1611	14 51.180N	142 15.107E	2.1	1494	29.6	7	4685
2007914	145	532	14 06.152N	142 30.091E	2.1	1704	29.5	20	11737

1) Biological responses to typhoon-induced perturbations in the subtropical NW Pacific Ocean

Atsushi Tsuda, Koji Suzuki
and Takato Matsui

The subtropical North Pacific is an oligotrophic ocean characterized by stable low biomass throughout a year, which is caused by low nutrients supply from the depth by stable hydrothermal stratification. Ocean-color satellite remote sensing has recently revealed that significant increases in chlorophyll-a concentration occurred along typhoon trajectories. Two processes have been proposed for the increase in phytoplankton biomass by typhoon. The first is nutrient supply by mixing of deep water and the second is rise of nutricline to the euphotic layer (upwelling). Since it is logistically impossible to observe the biogeochemical responses to typhoon-induced physical perturbations, we planed onboard incubation experiments which simulate upwelling and mixing events caused by typhoon.

Methods

Seawater sampling for incubation were carried out at Stns. 46 and 89 using a CTD-CMS system. To simulate the mixing events, we mixed the water from 10 m (nutrient-depleted water), subsurface water (phytoplankton-rich water) and from 200 m (nutrient-rich water) and incubated in a temperature-controlled tank (25-26°C) under the 50% of PAR, which was continuously measured on deck. To simulate the upwelling, the water from 145-150 m (the depth of chlorophyll maximum + 30 m) was also incubated in the same tank mentioned above. We also incubated the water from 10 m as a control. The water samples were collected at 1 or 2 day intervals for size-fractionated chlorophyll concentration by fluorometry, phytoplankton community composition by microscopy, flow cytometry, HPLC pigments, and PCR-DGGE, algal photosynthetic competence by PAM fluorometry, and nutrients by colorimetry using an auto-analyzer.

Preliminary results

In all the treatments, chlorophyll-a concentration decreased at the beginning of the experiment, which could be caused by photo-damage and/or photo-acclimation. From the day 2, chlorophyll concentration increased in the mixing treatment and upwelling treatment. Especially, micro-sized chlorophyll-a (>10 μm) was initially minor component in both the surface and subsurface waters but increased exponentially in both treatments (Fig. 1). A rough estimation of their apparent growth rate was 1.2 d^{-1}, corresponding to about 2 divisions per day. More interestingly, preliminary microscopic observation revealed that the increased phytoplankton consisted of chain-forming centric diatoms, which are frequently observed in coastal and highly productive areas but scarce in oligotrophic subtropical oceans. These results suggest that typhoon perturbations and diatoms production in the study area should be much more important than we have recognized so far.

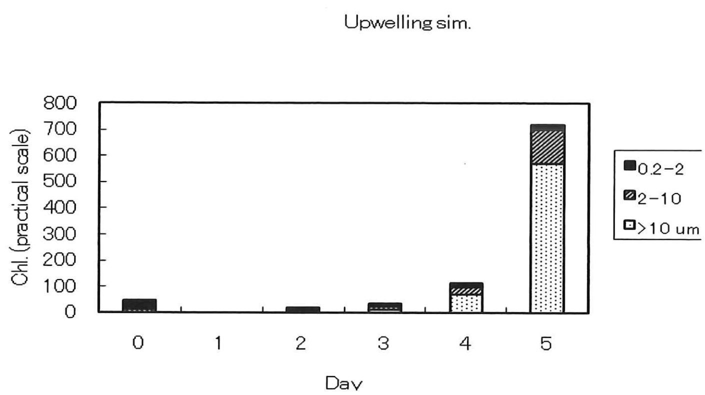

Fig. 1. Temporal changes in size-fractionated chlorophyll-a level in the upwelling-simulated bottles at Stn 46.

2) Biological N_2 fixation in the subtropical NW Pacific Ocean

Koji Suzuki, Takato Matsui
and Atsushi Tsuda

Although nitrogen is an important element in proteins and nucleic acids, microorganisms in subtropical surface waters often suffer from nitrogen availability. This is mainly due to that the permanent thermocline in the water column hinders the transportation of nitrate from deeper layer to the surface. However, it has become evident that some prokaryotes (both autotrohic and heterotrophic) can transform nitrogen gas (N_2) dissolved in seawater to biologically available nitrogen. The biological N_2 fixation plays key roles in both nitrogen and carbon cycles in most subtropical oceanic waters. As an eco-physiological aspect, it is of interest that some N_2 fixers (i.e., diazotrophs) in the open ocean could have different diel patterns of nitrogenase-encoding *nifH* gene expression. However, little is known about the composition of diazotrophs with their characteristics of N_2 fixation in the subtropical NW subtropical Pacific. Therefore, the following experiments were carried out during the Leg 3 of the KH-07-2 cruise:

Composition of diazotrophs

Seawater was collected from above 150 m depth at Stns. 49, 51, 55, 57, 60, 61, 63, 76, 106, and 143 using a clean plastic bucket or X-Niskin bottles attached with a CTD-CMS system. The seawater samples were filtered onto 25 mm Pall Corporation Supor membrane filters (0.2 μm in pore size) under gentle vacuum. The filter samples obtained were frozen in a deep-freezer (-80°C). Composition of diazotrophs will be examined on land with quantitative PCR and PCR-DGGE (denaturant gradient gel electrophoresis) targeting *nifH* gene fragments.

Estimates of biological N_2 fixing rate

Seawater was taken from 5 m at Stns. 49, 51, 55, and 57 using the X-Niskin bottles. The samples were transferred to 250 ml transparent glass vials. A certain amount of $^{15}N_2$ gas (99.8% in purity) was spiked into the each sample. Triplicate seawater samples were incubated on deck throughout a day with a simulated in situ incubation technique. After the incubation, the seawater was filtered onto pre-combusted 25 mm Whatman GF/F filters under gentle vacuum. The GF/F filters were kept frozen at -80°C until analysis on land. The amount and isotopic ratio of nitrogen contained in particulate matters will be analyzed by mass spectrometry. Biological N_2 fixing rate will be calculated by using a mass balance equation of nitrogen. Prof. Urumu Tsunogai of Hokkaido University is a research collaborator in this work.

Diel patterns of nifH gene expression and N_2 fixation rate
Seawater samples were collected from 0 m depth at Stns. 76, 106, and 143 using the plastic bucket and were transferred to 1 liter polycarbonate bottles for examining *nifH* gene expression. Concomitantly, seawater for estimating N_2 fixation rate was also collected and transferred to 250 ml glass vials. These were incubated on deck for 4, 8, 12, 16, 20, 24, 32, and 40 h intervals in general. The gene expression samples were filtered onto 25 mm Pall Corporation Supor membrane filters (0.2 μm in pore size) under gentle vacuum. Similarly, the N_2 fixation rate samples were treated as described above. The membrane filters were placed into 2 ml bead beater vials containing 600 μl RLT buffer, 1% β-mercaptoethanol, and ca.0.2 g of 0.1 mm glass beads for RNA extraction and the vials were stored at -80 °C. The expression of *nifH* gene will be estimated by quantitative reverse transcriptase PCR (RT-PCR) with 5' nuclease assay.

For the three experiments mentioned above, supplemental samples were also obtained for the analyses of nutrients by auto-analyzer, picoplankton by flow cytometry, and phytoplankton pigments by HPLC and fluorometry.

KH-07-2 Leg. 3 Neuston Net Record

Date	Station		Time	Latitude	longitude	Depth (m)	Heading (°)	Towing speed (kt)	Crrent direction (°)	Current speed (m/s)	Flowmeter Revolt.	Area Towed(m2)
70903	St.48	Net in	521	18 29.244N	140 00.883E	4686	159	2.5	66	1.4	7820	709
70903	St.48	Net out	535	18 28.894N	140 01.349E	4641	159	2	74	1.4		
70903	St.49	Net in	919	17 59.682N	140 00.565E	4742	181	2.7	36	0.4	12123	1099
70903	St.49	Net out	937	17 59.034N	140 00.666E	4555	180	2	163	3		
70903	St51	Net in	1623	16 59.039N	139 58.759E	4586	220	2.5	256	0.7	18654	1691
70903	St51	Net out	1656	16 58.023N	139 57.540E	5130	220	1.8	246	1		
70903	St52	Net in	1926	16 30.377N	139 59.966E	4541	217	2.3	288	0.5	20888	1894
70903	St52	Net out	1958	16 29.595N	139 59.028E	4655	220	2	298	0.3		
70903	St.53	Net in	2318	15 59.898N	139 59.841E	5120	220	2.4	61	0.3	20300	1840
70903	St.53	Net out	2353	15 58.944N	139 59.354E	5134	209	1.9				
70904	St55	Net in	620	14 59.783N	139 59.794E	4936	200	2.5	294	0.1	20454	1854
70904	St55	Net out	653	14 58.796N	139 59.350E	4883	200	1.9				
70904	St.56	Net in	928	14 30.280N	139 59.739E	4917	200	2.5			24257	2199
70904	St.56	Net out	1004	14 29.368N	139 59.058E	4911	200	2				
70904	St58	Net in	1654	13 29.699N	139 59.888E	4807	199	2.5	249	0.1	27040	2451
70904	St58	Net out	1733	13 28.188N	139 59.285E	4906	199	1.8	222	0.4		
70904	St.59	Net in	2051	12 59.903N	140 00.071E	4860	180	2.8	197	0.2	24600	2230
70904	St.59	Net out	2127	12 58.453N	140 00.012E	4580	180	1.7	185	4.1		
70909	St98	Net in	1741	13 51.282N	142 30.117E	2586	30	2.1	359	0.9	13121	1190
70909	St98	Net out	1807	13 52.354N	142 30.565E	2523	40	1.6	350	1		
70910	St102	Net in	441	13 51.189N	142 59.952E	2572	359	2.4	255	0.5	17130	1553
70910	St102	Net out	506	13 52.119N	142 59.756E	2989	359	1.9				
70910	St105	Net in	1055	14 35.930N	142 59.733E	2686	279	2.3	343	0.2	15910	1442
70910	St105	Net out	1118	14 36.070N	142 58.846E	2727	279	2.1	277	4.8		
70911	St113	Net in	353	14 36.024N	142 30.114E	2403	120	2.8	346	0.7	16003	1451
70911	St113	Net out	418	14 35.801N	142 30.841E	2047	120	1.9				

KH-07-2 Leg. 3 Neuston Net Record

Date	Station		Time	Latitude	longitude	Depth (m)	Heading (°)	Towing speed (kt)	Crrent direction (°)	Current speed (m/s)	Flowmeter Revolt.	Area Towed(m2)
70903	St.48	Net in	521	18 29.244N	140 00.883E	4686	159	2.5	66	1.4	7820	709
70911	St114	Net in	826	13 51.113N	142 59.961E	2587	70	2.5	193	0.7	15703	1424
70911	St114	Net out	851	13 51.156N	143 00.801E	2720	70	1.8				
70911	St.117	Net in	1514	14 35.847N	142 59.642E	2684	300	2.6	203	0.4	15956	1447
70911	St.117	Net out	1538	14 36.161N	142 58.737E	2728	299	1.8				
70912	St124	Net in	552	14 21.287N	142 30.057E	3660	71	2.2	341	1.5	12802	1161
70912	St124	Net out	617	14 22.156N	142 30.630E	3634	68	1.4	356	2.1		
70912	St.126	Net in	1218	15 05.548N	141 45.005E	4552	179	2.5	228	0.3	15859	1438
70912	St.126	Net out	1239	15 04.631N	141 44.927E	4562	180	1.9	220	0.4		
70912	St128	Net in	1626	14 36.086N	141 44.940E	4599	170	2.5	250	0.5	15018	1362
70912	St128	Net out	1648	14 35.296N	141 44.854E	4597	170	1.9				
70913	St134	Net in	512	14 21.455N	141 59.874E	4326	308	1.9	357	0.9	13606	1234
70913	St134	Net out	537	14 22.287N	141 59.232E	4365	309	1.7	354	1		
70913	St137	Net in	1136	15 05.856N	142 00.076E	4486	200	2.6			17587	1594
70913	St137	Net out	1159	15 05.232N	141 59.558E	4491	219	2.5				
70913	St139	Net in	1611	14 51.180N	142 15.107E	4334	173	2.1			16475	1494
70913	St139	Net out	1637	14 50.388N	142 15.063E	4382	172	2.2				
70914	St145	Net in	532	14 06.152N	142 30.091E	3116	321	2.1	343	1.6	18795	1704
70914	St145	Net out	557	14 06.951N	142 29.522E	3124	321	2.3	132	0.5		

Towing method: surface

Flowmeter No.: 2837

KH-07-2 Leg1・3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
T-1-1	N 24-56.7 E142-15.9	N 24-56.8 E142-22.8	070805	08:26	10:06	IKMT	5.0	Step	1535	0-406	1.0	4.0	96467	127070	1647	—
T-1-2	N 24-56.9 E142-23.1	N 24-56.8 E142-27.2	070805	10:21	11:29	IKMT	5.0	Step	1163	0-356	1.0	4.0~2.0	4988?	6570?	1647	—
P-1	N 16-34.3 E143-09.1	N 16-32.1 E143-07.8	070806	23:44	24:36	IKMT	5.0	Step	684	0-213	1.0~スロー	4.0~2.0	3869?	5096?	1647	1658~2053
P-6	N 16-31.0 E143-08.1	N 16-30.9 E143-10.4	070807	*09:04*	*09:48*	IKMT	5.0	Step	827	0-232	1.0~スロー	4.0~2.0	31992	42141	1647	—
P-7	N 16-30.9 E143-10.4	N 16-31.0 E143-07.4	070807	10:06	10:55	IKMT	5.0	Step	894	0-252	1.0~スロー	4.0~2.0	40887	53858	1647	—
P-8	N 16-35.9 E143-07.8	N 16-27.7 E143-07.8	070807	11:45	14:14	IKMT	5.0	Step	875	0-257	1.0~スロー	4.0~2.0	123853?	163144?	1647	874~1982
A-2	N 15-38.6 E142-44.6	N 15-37.3 E143-45.6	070808	00:46	01:18	IKMT	5.0	Step	328	0-94	1.0	4.0~2.0	27139	35748	1647	389~1029
A4	N 15-40.9 E142-44.3	N 15-35.7 E142-44.4	070808	04:30	05:56	IKMT	5.0	Step	712	0-199	1.0	4.0~2.0	79871	105210	1647	2000~4582
S-5	N 14-12.9 E142-52.9	N 14-12.3 E142-54.0	070808	14:08	14:30	IKMT	5.0	Step	273	0-103	1.0	4.0~2.0	16927	22297	1647	331~972
S-7	N 14-10.2 E142-51.8	N 14-16.1 E142-52.1	070808	16:13	17:45	IKMT	5.0	Step	813	0-225	1.0	4.0~2.0	90840	119658	1647	622~1436
S-9	N 14-15.5 E142-51.2	N 14-15.6 E142-54.4	070808	19:55	20:52	IKMT	5.0	Step	1173	0-325	1.0	4.0~2.0	44888	59128	1647	1227~1572
S-10	N 14-14.4 E142-55.9	N 14-11.6 E142-52.8	070808	21:19	22:48	IKMT	5.0	Step	1086	0-299	1.0	4.0~2.0	58536	77106	1647	800~1705
S-11	N 14-10.1 E142-53.6	N 14-14.4 E142-51.6	070808	23:20	25:00	IKMT	5.0	Step	1086	0-302	1.0	4.0~2.0	77930	102652	1647	762~1564
S-12	N 14-16.7 E142-50.9	N 14-13.6 E142-54.9	070809	01:47	03:38	IKMT	5.0	Step	1136	0-318	1.0~0.3	4.0~2.0	85792	113009	1647	790~1875
S-13	N 14-15.7 E142-55.9	N 14-13.5 E142-56.3	070809	04:24	05:36	IKMT	5.0	Step	470	0-147	1.0~0.3	2.5~1.5	47350	62372	1647	1660~1834
S-14	N 14-15.9 E142-49.7	N 14-12.8 E142-50.1	070809	06:49	08:26	ORIBF	0.5	Step	545	0-183	1.0~0.3	2.5~2.0	47075	74789	1307	1389~1863
A-12	N 15-37.0 E142-42.6	N 15-39.7 E142-47.2	070809	17:18	18:56	IKMT	5.0	Step	1170	0-308	1.0	4.0~2.0	78154	102948	1647	743~2387
A-13	N 15-40.3 E142-47.4	N 15-36.2 E142-46.0	070809	19:30	21:11	IKMT	5.0	Step	1201	0-302	1.0	4.0~2.0	72963	96110	1647	913~1491
A-14	N 15-35.1 E142-47.3	N 15-38.9 E142-43.3	070809	21:39	23:31	IKMT	5.0	Step	1173	0-306	1.0	4.0~2.0	76161	100323	1647	798~2724
A-15	N 15-39.9 E142-43.0	N 15-36.8 E142-43.0	070809	23:59	25:31	ORIBF	0.5	Step	291	0-160	1.0~0.3	2.5~2.0	34498	54808	1307	2052-2448
S-15	N 14-15.8 E142-50.6	N 14-11.2 E142-53.2	070810	07:16	09:03	IKMT	5.0	Step	1265	0-309	1.0	4.0~2.0	87600	115390	1647	772-1760
S-16	N 14-10.7 E142-51.9	N 14-13.0 E142-54.4	070810	09:33	10:49	IKMT	5.0	Step	1064	0-305	1.0	4.0~2.0	49529	65242	1647	819-1345

KH-07-2 Leg1·3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
S-17	N 14-12.7 E142-56.2	N 14-15.9 E142-52.0	070810	11:14	13:10	IKMT	5.0	Step	1076	0-306	1.0	4.0~2.0	76955	101368	1647	789-1505
S-18	N 14-16.0 E142-51.0	N 14-12.2 E142-50.9	070810	13:35	15:27	ORIBF	0.5	Step	544	0-246	1.0~0.5	2.5~2.0	45088	71632	1307	1151~1683
S-19	N 14-11.8 E142-51.1	N 14-11.8 E142-55.6	070810	15:47	17:07	IKMT	5.0	Step	1330	0-304	1.0	4.0~2.0	64174	84532	1647	856~1567
S-20	N 14-11.5 E142-54.7	N 14-15.4 E142-54.5	070810	17:28	18:59	IKMT	5.0	Step	1079	0-323	1.0	4.0~2.0	59799	78770	1647	939~1454
S-21	N 14-15.3 E142-54.7	N 14-15.3 E142-51.1	070810	19:11	20:24	IKMT	5.0	Step	1123	0-311	1.0	4.0~2.0	53655	70676	1647	1057~1506
S-22	N 14-15.7 E142-51.2	N 14-11.5 E142-51.2	070810	20:40	22:07	IKMT	5.0	Step	1160	0-327	1.0	4.0~2.0	63041	83040	1647	1044~1419
S-23	N 14-11.5 E142-51.3	N 14-15.3 E142-51.3	070810	22:30	24:22	ORIBF	0.5	Step	609	0-278	1.0~0.5	2.5~2.0	45108	71665	1307	996-1414
S-24	N 14-15.2 E142-51.2	N 14-15.2 E142-54.6	070811	00:50	01:58	IKMT	5.0	Step	1133	0-306	1.0	4.0~2.0	54417	71680	1647	1069~1474
S-25	N 14-15.5 E142-54.9	N 14-11.9 E142-54.3	070811	02:16	03:30	IKMT	5.0	Step	1148	0-310	1.0	4.0~2.0	54313	71543	1647	1005~1598
S-26	N 14-11.7 E142-59.8	N 14-11.7 E142-50.8	070811	03:55	05:06	IKMT	5.0	Step	1194	0-314	1.0	4.0~2.0	56656	74630	1647	845~1476
S-27	N 14-11.5 E142-51.1	N 14-15.7 E142-51.4	070811	05:20	06:36	IKMT	5.0	Step	1175	0-306	1.0	4.0~2.0	60959	80298	1647	982-1454
S-28	N 14-15.7 E142-51.4	N 14-12.0 E142-51.4	070811	07:02	09:05	ORIBF	0.5	Step	704	0-268	1.0~0.5	2.5~2.0	51005	81034	1307	1022~1550
S-29	N 14-11.8 E142-50.8	N 14-11.7 E142-54	070811	09:36	10:52	IKMT	5.0	Step	1139	0-317	1.0	4.0~2.0	61895	81530	1647	865~1489
S-30	N 14-11.3 E142-54.5	N 14-15.1 E142-54.5	070811	11:14	12:37	IKMT	5.0	Step	1160	0-297	1.0	4.0~2.0	59534	78420	1647	954-1515
S-31	N 14-15.2 E142-55.1	N 14-15.3 E142-51.3	070811	12:57	14:22	IKMT	5.0	Step	1068	0-319	1.0	4.0~2.0	61238	80665	1647	1074~1580
S-32	N 14-15.7 E142-51.2	N 14-11.5 E142-51.3	0708011	14:39	16:00	IKMT	5.0	Step	1058	0~308*	1.0	4.0~2.0	57176	75315	1647	1020~1437
S-33	N 14-11.3 E142-51.2	N 14-14.9 E142-51.4	070811	16:20	18:07	ORIBF	0.5	Step	641	0~285*	1.0~0.5	2.5~2.0	45541	72353	1307	981~1448
S-34	N 14-15.2 E142-50.9	N 14-15.2 E142-54.9	070811	18:29	19:37	IKMT	5.0	Step	1276	0~295	1.0	4.0~2.0	58075	76499	1647	1053~1425
S-35	N 14-15.7 E142-54.5	N 14-11.8 E142-54.5	070811	19:53	21:06	IKMT	5.0	Step	1150	0~301	1.0	4.0~2.0	54189	71380	1647	960~1457
S-36	N 14-11.7 E142-54.9	N 14-11.7 E142-51.5	070811	21:24	22:35	IKMT	5.0	Step	1055	0~303	1.0	4.0~2.0	45853	60400	1647	836~1376
S-37	N 14-11.3 E142-51.3	N 14-14.9 E142-51.3	070811	23:01	24:28	ORIBF	0.5	Step	500	0~234	1.0~0.5	2.5~2.0	41600	66092	1307	1023~1358
S-38	N 14-15.6 E142-51.4	N 14-11.4 E142-51.3	070812	01:10	02:27	IKMT	5.0	Step	1202	0~294	1.0	4.0~2.0	61256	80689	1647	1060~1430

KH-07-2 Leg1・3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
S-39	N 14-11.7 E142-50.8	N 14-11.8 E142-54.3	070812	02:55	04:41	ORIBF	0.5	Step	506	0~250	1.0~0.5	2.5~2.0	49084	77981	1307	853~1473
S-40	N 14-11.3 E142-54.6	N 14-15.3 E142-54.5	070812	05:01	06:30	IKMT	5.0	Step	1094	0~313	1.0	4.0~2.0	60302	79432	1647	935~1542
S-41	N 14-15.3 E142-55.1	N 14-15.3 E142-51.0	070812	06:45	08:00	IKMT	5.0	Step	1245	0~349	1.0	4.0~2.0	54802	72188	1647	1061~1598
S-42	N 14-15.8 E142-51.4	N 14-11.6 E142-51.3	070812	08:27	10:40	ORIBF	0.5	Step	602	0~245	1.0~0.5	2.5~2.0	55799	88650	1307	998~1567
S-43	N 14-11.5 E142-51.3	N 14-15.0 E142-51.3	070812	11:01	12:13	IKMT	5.0	Step	1174	0~317	1.0	4.0~2.0	49558	65280	1647	1037~1423
S-44	N 14-15.5 E142-51.2	N 14-15.6 E142-55.3	070812	12:30	13:45	IKMT	5.0	Step	1236	0~308	1.0	4.0~2.0	67725	89210	1647	1072~1699
S-45	N 14-15.4 E142-54.7	N 14-11.0 E142-54.4	070812	14:04	15:23	IKMT	5.0	Step	1266	0~307	1.0	4.0~2.0	65493	86270	1647	1074~1565
S-46	N 14-11.7 E142-55.9	N 14-11.7 E142-51.9	070812	15:52	17:52	ORIBF	0.5	Step	500	0~306	1.0~0.5	2.5~2.0	34269	54445	1307	857~(1228)
S-47	N 14-11.5 E142-51.4	N 14-15.3 E142-51.3	070812	18:09	20:27	ORIBF	0.5	Step	499	0~296	1.0~0.5	2.5~2.0	44666	70963	1307	977~1387
S-48	N 14-15.7 E142-51.3	N 14-11.4 E142-51.2	070812	20:50	22:05	IKMT	5.0	Step	1299	0~313	1.0	4.0~2.0	63660	83855	1647	1048~1436
S-49	N 14-11.7 E142-51.1	N 14-11.5 E142-55.6	070812	22:29	24:24	ORIBF	0.5	Step	830	0-343*	1.0~0.5	2.5~2.0	53597	85152	1307	940~1647
S-50	N 14-11.3 E142-54.6	N 14-15.3 E142-54.5	070813	00:54	02:31	IKMT	5.0	Step	1300	0-419*	1.0	4.0~2.0	64098	84432	1647	915~1517
S-51	N 14-15.5 E142-55.0	N 14-15.2 E142-50.9	070813	02:49	04:12	IKMT	5.0	Step	1300	0-416*	1.0	4.0~2.0	55236	72759	1647	1032~1635
S-52	N 14-15.3 E142-51.3	N 14-10.9 E142-50.9	070813	04:30	06:23	ORIBF	0.5	Step	981	0-354	1.0~0.5	2.5~2.0	52214	82954	1307	1044~1560
S-53	N 14-11.2 E142-51.4	N 14-14.7 E142-51.2	070813	06:45	07:57	IKMT	5.0	Step	1118	0-306	1.0	4.0~2.0	58509	77070	1647	1041~1455
S-54	N 14-15.3 E142-50.8	N 14-15.2 E142-54.4	070813	08:20	10:07	ORIBF	0.5	Step	839	0-375	1.0~0.5	2.5~2.0	42915	68180	1307	1063~1509
S-55	N 14-15.6 E142-54.5	N 14-10.8 E142-54.6	070813	10:31	11:56	IKMT	5.0	Step	1360	0-317	1.0	4.0~2.0	72104	94978	1647	996~1653
S-56	N 14-11.7 E142-54.9	N 14-11.7 E142-50.6	070813	12:25	14:29	ORIBF	0.5	Step	802	0-391	1.0~0.5	2.5~2.0	48252	76660	1307	848~1505
S-57	N 14-11.3 E142-51.3	N 14-15.4 E142-51.2	070813	14:50	17:34	ORIBF	0.5	Step	641	0-399	1.0~0.5	2.5~2.0	52262	83030	1307	994~1441
S-58	N 14-15.7 E142-51.3	N 14-11.0 E142-51.3	070813	17:49	19:04	IKMT	5.0	Step	1364	0-313	1.0	4.0~2.0	65429	86186	1647	1046~1517
S-59	N 14-11.6 E142-51.1	N 14-11.8 E142-55.1	070813	19:23	21:13	ORIBF	0.5	Step	1009	0-353	1.0~0.5	2.5~2.0	50345	79985	1307	842~1457
S-60	N 14-11.4 E142-54.5	N 14-15.1 E142-54.5	070813	21:44	22:03	IKMT	5.0	Step	1207	0-315	1.0	4.0~2.0	59211	77995	1647	937~1468

KH-07-2 Leg1·3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
S-61	N 14-15.3 E142-55.1	N 14-15.3 E142-50.9	070813	23:25	25:31	ORIBF	0.5	Step	797	0-366	1.0~0.5	2.5~2.0	45093	71640	1307	1053~1616
S-62	N 14-15.5 E142-51.3	N 14-10.8 E142-51.4	070814	01:49	03:54	ORIBF	0.5	Step	888	0-383	1.0~0.5	2.5~2.0	51842	82363	1307	1013-1503
S-63	N 14-10.7 E142-51.3	N 14-14.1 E142-51.2	070814	04:06	05:17	IKMT	5.0	Step	1175	0-304	1.0	4.0~2.0	49962	65812	1647	1054~1560
1	N 15-15.7 E142-45.3	N 15-13.1 E142-45.1	070814	09:54	11:04	ORIBF	0.5	Step	807	0-351	1.0~0.5	2.5~2.0	32202	51160	1307	3500~3632
2	N 15-00.0 E142-44.9	N 14-57.9 E142-44.5	070814	12:20	13:24	ORIBF	0.5	Step	712	0-357	1.0~0.5	2.5~2.0	24732	39293	1307	2594~3112
3	N 14-45.1 E142-45.1	N 14-43.0 E142-45.1	070814	14:33	15:49	ORIBF	0.5	Step	636	0-359	1.0~0.3	2.5~2.0	25901	41150	1307	3581~3616
4	N 14-30.0 E142-45.1	N 14-26.5 E142-44.3	070814	16:58	18:22	ORIBF	0.5	Step	999	0-356	1.0~0.5	2.5~2.0	40026	63590	1307	2650~2974
5	N 14-15.3 E142-45.3	N 14-12.2 E142-44.7	070814	19:25	20:37	ORIBF	0.5	Step	858	0-353	1.0~0.5	2.5~2.0	32642	51860	1307	1985~2408
6	N 13-59.8 E142-45.0	N 13-57.3 E142-44.3	070814	21:50	23:06	ORIBF	0.5	Step	737	0-377	1.0~0.5	2.5~2.0	29262	46490	1307	1598~1857
7	N 13-44.9 E142-45.1	N 13-42.0 E142-46.1	070815	00:16	01:36	ORIBF	0.5	Step	852	0-351	1.0~0.3	2.2~1.6	33631	53430	1307	3300~4289
8	N 13-30.0 E142-45.0	N 13-27.9 E142-46.9	070815	02:43	04:04	ORIBF	0.5	Step	735	0-389	1.0~0.5	2.5~2.0	30935	49147	1307	2946~3204
9	N 13-15.1 E142-45.4	N 13-15.8 E142-42.4	070815	05:13	06:36	ORIBF	0.5	Step	742	0-354	1.0~0.5	2.5~2.0	31384	49860	1307	4250~4570
10	N 13-22.4 E142-29.9	N 13-24.6 E142-29.6	070815	07:51	09:00	ORIBF	0.5	Step	673	0-376	1.0~0.3	2.5~2.0	27097	43050	1307	1959~2807
11	N 13-37.5 E142-30.0	N 13-39.7 E142-30.7	070815	10:15	11:23	ORIBF	0.5	Step	811	0-351	1.0~0.3	2.5~2.0	28262	44900	1307	2726~2768
12	N 13-52.6 E142-30.1	N 13-54.4 E142-32.0	070815	12:38	13:50	ORIBF	0.5	Step	762	0-352	1.0~0.5	2.5~2.0	32051	50920	1307	2550~2752
13	N 14-07.6 E142-30.1	N 14-09.4 E142-31.9	070815	15:02	16:07	ORIBF	0.5	Step	766	0-353	1.0~0.5	2.5~2.0	27450	43610	1307	2848~3402
14	N 14-22.4 E142-30.0	N 14-24.5 E142-29.4	070815	17:18	18:25	ORIBF	0.5	Step	727	0-363	1.0~0.5	2.5~2.0	26808	42591	1307	3629~3701
15	N 14-37.2 E142-30.2	N 14-38.7 E142-28.9	070815	19:35	20:36	ORIBF	0.5	Step	666	0-378	1.0~0.3	2.5~2.0	21004	33370	1307	2781~3450
16	N 14-52.5 E142-30.0	N 14-54.3 E142-28.9	070815	21:55	22:56	ORIBF	0.5	Step	705	0-370	1.0~0.3	2.5~2.0	28472	45234	1307	4099~4156
17	N 15-07.5 E142-30.0	N 15-09.2 E142-28.7	070816	00:11	01:15	ORIBF	0.5	Step	730	0-370	1.0~0.3	2.5~2.0	24409	38780	1307	3998~4151
18	N 15-22.5 E142-29.8	N 15-22.0 E142-28.0	070816	02:31	03:28	ORIBF	0.5	Step	639	0-375	1.0~0.3	2.5~2.0	27283	43345	1307	4026~4102
19	N 15-14.9 E141-45.0	N 15-12.3 E142-44.6	070816	06:33	07:46	ORIBF	0.5	Step	899	0-361	1.0~0.5	2.5~2.0	30417	48324	1307	4505~4530

KH-07-2 Leg1・3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
20	N 15-00.0 E141-45.0	N 14-57.2 E141-44.7	070816	08:57	10:17	ORIBF	0.5	Step	868	0-384	1.0~0.3	2.5~2.0	32041	50905	1307	4598~4613
21	N 14-44.9 E141-45.0	N 14-41.2 E141-43.7	070816	11:30	12:54	ORIBF	0.5	Step	1031	0-351	1.0~0.5	2.5~2.0	40786	64798	1307	4600~4621
34	N 14-52.1 E141-59.6	N 14-50.1 E141-57.1	070816	14:35	15:55	ORIBF	0.5	Step	840	0-351	1.0~0.3	2.5~2.0	34164	54278	1307	4492~4516
35	N 15-07.3 E141-59.9	N 15-08.0 E141-57.0	070816	17:59	19:19	ORIBF	0.5	Step	678	0-354	1.0~0.3	2.5~2.0	35783	56850	1307	4448~4544
37	N 15-14.9 E142-15.0	N 15-14.3 E142-11.5	070816	21:01	22:21	ORIBF	0.5	Step	777	0-348	1.0~0.5	2.5~2.0	34295	54485	1307	4221~4347
38	N 14-59.6 E142-13.6	N 14-57.7 E142-11.5	070816	23:43	24:57	ORIBF	0.5	Step	780	0-348	1.0~0.5	2.5~2.0	28545	45350	1307	4411~4430
39	N 14-45.2 E142-14.7	N 14-43.8 E142-11.7	070817	02:10	03:28	ORIBF	0.5	Step	914	0-352	1.0~0.3	2.5~2.0	35487	56380	1307	4313~4337
33	N 14-37.5 E141-59.9	N 14-37.8 E141-57.2	070817	04:38	05:51	ORIBF	0.5	Step	747	0-351	1.0~0.5	2.5~2.0	28024	44523	1307	4334~4408
22	N 14-29.7 E141-44.9	N 14-27.8 E141-43.2	070817	07:06	08:21	ORIBF	0.5	Step	794	0-363	1.0~0.5	2.5~2.0	27776	44128	1307	4583~4602
23	N 14-15.0 E141-44.9	N 14-15.0 E141-46.6	070817	09:37	10:44	ORIBF	0.5	Step	710	0-386	1.0~0.3	2.5~2.0	20953	33289	1307	4093~4538
32	N 14-22.5 E142-00.0	N 14-22.9 E142-01.7	070817	12:08	13:13	ORIBF	0.5	Step	642	0-370	1.0~0.3	2.5~2.0	19840	31521	1307	4277~4339
40	N 14-29.8 E142-15.1	N 14-27.9 E142-17.0	070817	14:36	15:54	ORIBF	0.5	Step	750	0-357	1.0~0.5	2.5~2.0	31146	49483	1307	4015~4124
41	N 14-15.0 E142-15.0	N 14-13.6 E142-12.1	070817	17:01	18:19	ORIBF	0.5	Step	760	0-352	1.0~0.5	2.5~2.0	30098	47818	1307	47818
31	N 14-07.5 E141-59.8	N 14-06.2 E141-56.9	070817	19:27	20:38	ORIBF	0.5	Step	804	0-348	1.0~0.5	2.5~2.0	29369	46660	1307	4378~4391
24	N 14-00.1 E141-45.2	N 13-58.1 E141-43.4	070817	21:51	22:58	ORIBF	0.5	Step	780	0-354	1.0~0.5	2.5~2.0	27603	43853	1307	4548~4649
25	N 13-45.1 E141-45.1	N 13-45.3 E141-47.5	070818	00:12	01:18	ORIBF	0.5	Step	762	0-359	1.0~0.5	2.5~2.0	26871	42691	1307	4301~4362
30	N 13-52.5 E141-59.8	N 13-51.9 E141-57.9	070818	02:37	03:33	ORIBF	0.5	Obl.	1020	0-502	1.0~0.5	2.5~2.0	21917	34820	1307	4174~4219
25-2	N 13-44.9 E141-44.8	N 13-42.0 E141-43.0	070818	04:49	06:20	ORIBF	0.5	Step	1213	0-600	1.0~0.5	2.5~2.0	36432	57880	1307	4363~4386
26	N 13-30.0 E141-44.8	N 13-30.1 E141-47.3	070818	07:26	08:38	ORIBF	0.5	Step	799	0-400*	1.0~0.5	2.5~2.0	30365	48242	1307	2672~3051
29	N 13-37.3 E142-00.1	N 13-35.3 E141-58.9	070818	10:00	11:03	ORIBF	0.5	Step	709	0-351	1.0~0.5	2.5~2.0	23834	37866	1307	3545~3691
28	N 13-22.6 E141-59.9	N 13-22.6 E142-02.2	070818	12:16	13:20	ORIBF	0.5	Step	719	0-354	1.0~0.5	2.5~2.0	25583	40645	1307	2837~2974
45	N 13-15.0 E142-15.1	N 13-15.6 E142-17.6	070818	14:41	15:46	ORIBF	0.5	Step	764	0-360	1.0~0.5	2.5~2.0	27098	43052	1307	2408-2497

KH-07-2 Leg1・3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
44	N 13-30.0 E142-15.2	N 13-31.3 E142-13.5	070818	17:05	18:07	ORIBF	0.5	Step	703	0-383	1.0~0.3	2.5~2.0	23315	37042	1307	3188~3209
43	N 13-45.2 E142-14.8	N 13-46.9 E142-12.4	070818	19:21	20:35	ORIBF	0.5	Step	813	0-352	1.0~0.5	2.5~2.0	29279	46517	1307	3037~3484
42	N 14-00.1 E142-14.8	N 14-00.1 E142-17.6	070818	21:50	23:10	ORIBF	0.5	Step	1078	0-511	1.0~0.5	2.5~2.0	33266	52850	1307	3261~3565
47	N 18-59.6 E140-00.4	N 18-59.6 E140-00.6	070903	00:55	01:04	NORPAC		Ver.	157	0-150	0.7~1.0	0	29.80 35.85	1546 1773	3434XX 3433GG	4251~4281
47	N 18-59.5 E140-01.5	N 18-58.3 E140-03.3	070903	01:53	02:46	ORIBF	0.5	Obl.	1022	0-503	1.0~0.5	2.5~2.0	23110	37301	1647	4469~4494
48	N 18-29.7 E140-00.3	N 18-28.2 E140-02.3	070903	05:05	06:04	ORIBF	0.5	Obl.	1104	0-502	1.0~0.5	2.5~2.0	26137	42188	1647	4648~4704
49	N 17-59.9 E140-00.1	N 17-59.9 E140-00.2	070903	08:33	08:46	NORPAC		Ver.	156	0-150	0.7~1.0	0	31.08 32.55	1612 1610	3434XX 3433GG	5194~5187
49	N 17-59.9 E140-00.5	N 17-58.2 E140-00.8	070903	09:13	10:07	ORIBF	0.5	Obl.	980	0-513	1.0~0.5	2.5~2.0	21467	34650	1647	4576~5148
50	N 17-29.9 E139-59.9	N 17-27.8 E139-59.2	070903	12:17	13:12	ORIBF	0.5	Obl.	984	0-504	1.0~0.5	2.5~2.0	23860	38512	1647	4878~4890
51	N 16-59.5 E139-59.5	N 16-59.5 E139-59.5	070903	15:36	15:43	NORPAC		Ver.	155.5	0-150	0.7~1.0	0	31.00 31.75	1608 1570	3434XX 3433GG	4508~4513
51	N 16-59.2 E139-59.0	N 16-57.4 E139-56.8	070903	16:15	17:18	ORIBF	0.5	Obl.	1123	0-502	1.0~0.5	2.5~2.0	27344	44136	1647	4609~5074
52	N 16-30.5 E140-00.1	N 16-29.3 E139-58.7	070903	19:20	20:09	ORIBF	0.5	Obl.	897	0-504	1.0~0.5	2.5~2.0	18153	29301	1647	4514~4761
53	N 16-00.2 E139-59.8	N 16-00.2 E139-59.8	070903	22:30	22:42	NORPAC		Ver.	151	0-150	0.7~1.0	0	16.39 30.33	850 1500	3434XX 3433GG	5144~5146
53	N 16-00.1 E140-00.0	N 15-58.6 E139-59.2	070903	23:10	24:06	ORIBF	0.5	Obl.	978	0-506	1.0~0.5	2.5~2.0	21731	35075	1647	5127~5153
54	N 15-29.8 E140-00.0	N 15-28.4 E139-59.0	070904	02:22	03:14	ORIBF	0.5	Obl.	935	0-499	1.0~0.5	2.5~2.0	20896	33728	1647	5048~5053
55	N 14-59.8 E139-59.8	N 14-59.9(E139-59.89	070904	05:40	05:53	NORPAC		Ver.	150	0-150	0.5~1.0	0	31.91 34.98	1655 1730	3434XX 3433GG	4940~4942
55	N 14-59.9 E139-59.9	N 14-58.4 E139-59.2	070904	06:16	07:08	ORIBF	0.5	Obl.	999	0-504	1.0~0.5	2.5~2.0	20394	32918	1647	4864~4943
56	N 14-30.4 E139-59.8	N 14-29.1 E139-58.9	070904	09:23	10:17	ORIBF	0.5	Obl.	958	0-507	1.0~0.5	2.5~2.0	20835	33630	1647	4889~4917
57	N 14-00.0 E139-59.7	N 14-00.1[illegible] E139-59.56	070904	12:41	12:55	NORPAC		Ver.	160	0-150	0.7~1.0	0	32.81 34.54	1702 1708	3434XX 3433GG	5025~5026
57	N 14-00.4 E139-59.2	N 13-59.0 E139-58.1	070904	13:43	14:36	ORIBF	0.5	Obl.	987	0-505	1.0~0.5	2.5~2.0	22306	36004	1647	5024~5027
58	N 13-30.0 E139-60.0	N 13-27.6 E139-59.0	070904	16:46	17:51	ORIBF	0.5	Obl.	1162	0-497	1.0~0.5	2.5~2.0	27886	45010	1647	4719~4910
59	N 12-59.8 E140-00.0	N 12-59.9 E140-00.0	070904	20:04	20:12	NORPAC		Ver.	152	0-150	0.7~1.0	0	48.97 33.56	2540 1660	3434XX 3433GG	4860~4862

KH-07-2 Leg1·3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
59	N 13-30.0 E140-00.1	N 12-57.8 E140-00.0	070904	20:47	21:47	ORIBF	0.5	Obl.	1081	0-502	1.0~0.5	2.5~2.0	23239	37510	1647	4366~4862
64	N 14-15.3 E142-36.6	N 14-17.4 E142-37.2	070906	01:05	02:03	ORIBF	0.5	Obl.	1067	0-506	1.0~0.5	2.5~2.0	25447	41074	1647	2785~2982
65	N 14-30.2 E142-52.0	N 14-28.8 E142-51.8	070906	03:44	04:39	ORIBF	0.5	Obl.	1032	0-518	1.0~0.5	2.5~2.0	20335	32822	1647	2194~2369
66	N 13-51.3 E143-00.1	N 13-53.3 E143-01.4	070906	14:00	15:00	ORIBF	0.5	Obl.	1068	0-499	1.0~0.5	2.5~2.0	26012	41985	1647	2342~2561
67	N 14-06.0 E142-59.9	N 14-08.6 E142-58.9	070906	16:13	17:15	ORIBF	0.5	Obl.	1194	0-505	1.0~0.5	2.5~2.0	28727	46367	1647	3348~3807
68	N 14-20.8 E143-00.2	N 14-22.9 E142-59.6	070906	18:22	19:16	ORIBF	0.5	Obl.	1007	0-503	1.0~0.5	2.5~2.0	22357	36086	1647	1837~1880
69	N 14-36.1 E143-00.1	N 14-37.7 E142-59.4	070906	20:29	21:22	ORIBF	0.5	Obl.	893	0-504	1.0~0.5	2.5~2.0	18984	30642	1647	2690~2806
70	N 14-36.0 E142-45.0	N 14-34.6 E142-44.2	070906	22:41	23:35	ORIBF	0.5	Obl.	939	0-505	1.0~0.5	2.5~2.0	19748	31875	1647	3366~3375
71	N 14-20.9 E142-44.8	N 14-20.9 E142-42.7	070907	00:55	01:50	ORIBF	0.5	Obl.	1015	0-510	1.0~0.5	2.5~2.0	22135	35728	1647	2710~3072
72	N 14-05.7 E142-44.9	N 14-05.1 E142-43.3	070907	03:23	04:17	ORIBF	0.5	Obl.	1001	0-501	1.0~0.5	3.0~2.0	19206	31000	1647	2128~2337
73	N 13-51.2 E142-45.1	N 13-50.8 E142-43.3	070907	05:38	06:33	ORIBF	0.5	Obl.	948	0-500	1.0~0.5	2.5~2.0	20258	32698	1647	1876~2211
74	N 13-51.0 E142-30.0	N 13-53.6 E142-29.3	070907	07:43	08:45	ORIBF	0.5	Obl.	1123	0-496	1.0~0.5	2.5~2.0	27142	43810	1647	2584~2653
75	N 14-06.0 E142-30.1	N 14-08.0 E142-29.3	070907	09:52	10:52	ORIBF	0.5	Obl.	1063	0-507	1.0~0.5	2.5~2.0	22538	36379	1647	3097~3185
76	N 14-21.2 E142-29.9	N 14-22.8 E142-28.2	070907	12:08	13:04	ORIBF	0.5	Obl.	1074	0-507	1.0~0.5	2.5~1.8	25536	41217	1647	3661~3737
77	N 14-35.7 E142-30.1	N 14-34.4 E142-31.2	070907	14:19	15:12	ORIBF	0.5	Obl.	946	0-500	1.0~0.5	2.5~2.0	25825	41683	1647	2442~2579
78	N 13-51.1 E143-00.1	N 13-53.0 E143-01.1	070907	18:54	19:49	ORIBF	0.5	Obl.	1016	0-503	1.0~0.5	2.5~2.0	23836	38473	1647	2347~2548
79	N 14-06.0 E142-59.8	N 14-07.7 E142-58.3	070907	21:02	22:03	ORIBF	0.5	Obl.	1079	0-503	1.0~0.5	2.5~1.7	24825	40070	1647	3134~3861
80	N 14-20.9 E142-59.9	N 14-22.4 E143-01.0	070907	23:19	24:16	ORIBF	0.5	Obl.	1036	0-509	1.0~0.5	2.5~1.7	21777	35150	1647	1831~1880
81	N 14-35.4 E143-00.3	N 14-35.2 E143-58.4	070908	01:31	02:27	ORIBF	0.5	Obl.	1018	0-504	1.0~0.5	2.5~2.0	21607	34876	1647	2617~2684
82	N 14-36.4 E142-45.2	N 14-36.1 E142-43.3	070908	03:41	04:35	ORIBF	0.5	Obl.	968	0-500	1.0~0.5	2.5~2.0	20022	32318	1647	3376~3408
83	N 14-21.5 E142-45.1	N 14-20.9 E142-43.5	070908	05:59	06:53	ORIBF	0.5	Obl.	1005	0-507	1.0~0.5	2.5~2.0	19228	31035	1647	2625~3005
84	N 14-06.5 E142-44.8	N 14-06.2 E142-43.3	070908	08:19	09:12	ORIBF	0.5	Obl.	910	0-502	1.0~0.5	2.5~2.0	24496	39538	1647	2070~2255

KH-07-2 Leg1・3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m³)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
	Net in	Net out		Net in	Net out											
85	N 13-51.2 E142-44.8	N 13-51.2 E142-43.1	070908	10:38	11:30	ORIBF	0.5	Obl.	912	0-506	1.0~0.5	2.5~2.0	20053	32368	1647	1880~1961
86	N 13-51.3 E142-30.2	N 13-53.5 E142-29.0	070908	12:42	13:39	ORIBF	0.5	Obl.	1062	0-500	1.0~0.5	2.5~2.0	26404	42619	1647	2586~2618
87	N 14-06.3 E142-29.8	N 14-07.5 E142-28.2	070908	14:47	15:40	ORIBF	0.5	Obl.	990	0-506	1.0~0.5	2.5~2.0	22483	36290	1647	2832~3112
88	N 14-21.1 E142-30.0	N 14-23.4 E142-31.2	070908	16:48	17:46	ORIBF	0.5	Obl.	1118	0-504	1.0~0.5	2.5~2.0	25782	41614	1647	3630~3658
89	N 14-36.5 E142-29.7	N 14-37.4 E142-31.5	070908	19:30	20:29	ORIBF	0.5	Obl.	1112	0-503	1.0~0.5	2.5~2.0	23160	37382	1647	2481~2763
90	N 13-51.3 E143-00.1	N 13-53.2 E143-60.0	070909	00:29	01:26	ORIBF	0.5	Obl.	1021	0-504	1.0~0.5	2.5~2.0	23797	38411	1647	2564~2925
91	N 14-06.1 E143-00.0	N 14-08.1 E142-59.7	070909	02:38	03:35	ORIBF	0.5	Obl.	998	0-509	1.0~0.5	2.5~2.0	21435	34598	1647	3712~3880
92	N 14-21.0 E143-00.1	N 14-23.0 E142-59.7	070909	04:46	05:39	ORIBF	0.5	Obl.	992	0-500	1.0~0.5	2.5~2.0	20964	33838	1647	1834~1876
93	N 14-35.8 E142-59.8	N 14-36.7 E142-57.8	070909	06:50	07:43	ORIBF	0.5	Obl.	1026	0-503	1.0~0.5	2.5~2.0	21945	35421	1647	2681~2729
94	N 14-36.1 E142-45.2	N 14-35.4 E142-43.8	070909	08:52	09:44	ORIBF	0.5	Obl.	905	0-503	1.0~0.5	2.5~2.0	18243	29445	1647	3350~3390
95	N 14-21.4 E142-44.9	N 14-20.6 E142-43.3	070909	11:04	11:59	ORIBF	0.5	Obl.	960	0-507	1.0~0.5	2.5~2.2	21072	34012	1647	2683~3009
96	N 14-06.0 E142-45.0	N 14-04.3 E142-45.2	070909	13:20	14:13	ORIBF	0.5	Obl.	982	0-517	1.0~0.5	2.7~2.2	22050	35590	1647	2050~2128
97	N 13-51.4 E142-44.8	N 13-51.8 E142-42.7	070909	15:28	16:31	ORIBF	0.5	Obl.	1033	0-510	1.0~0.5	2.5~2.0	22582	36450	1647	1900~2035
98	N 13-51.1 E142-30.1	N 13-53.4 E142-31.0	070909	17:37	18:33	ORIBF	0.5	Obl.	1077	0-517*	1.0~0.5	2.5~2.0	25476	41120	1647	2570~2680
99	N 14-06-2 E142-30.0	N 14-08.7 E142-30.5	070909	19:37	20:37	ORIBF	0.5	Obl.	1133	0-503	1.0~0.5	2.3~1.5	25861	41742	1647	3116~3306
100	N 14-21.0 E142-30.0	N 14-23.0 E142-31.2	070909	21:44	22:43	ORIBF	0.5	Obl.	1067	0-515	1.0~0.5	2.5~1.8	22371	36109	1647	3629~3655
101	N 14-36.1 E142-30.0	N 14-37.2 E142-31.6	070909	23:53	24:46	ORIBF	0.5	Obl.	973	0-508	1.0~0.5	2.5~2.0	20675	33371	1647	2278~2561
102	N 13-51.1 E143-00.0	N 13-52.9 E142-59.6	070910	04:37	05:31	ORIBF	0.5	Obl.	989	0-500	1.0~0.5	2.5~2.0	21047	33971	1647	2522~3037
103	N 14-05.8 E143-00.0	N 14-07.6 E142-59.6	070910	06:40	07:34	ORIBF	0.5	Obl.	978	0-503	1.0~0.5	2.3~2.0	19819	31990	1647	3748~3858
104	N 14-20.9 E142-59.9	N 14-22.7 E142-59.8	070910	08:45	09:37	ORIBF	0.5	Obl.	921	0-506	1.0~0.5	2.5~2.0	19237	31050	1647	1837~1869
105	N 14-35.9 E142-59.9	N 14-36.2 E142-58.0	070910	10:50	11:43	ORIBF	0.5	Obl.	944	0-506	1.0~0.5	2.5~2.0	23783	38387	1647	2687~2723
106	N 14-36.1 E142-45.1	N 14-35.2 E142-43.5	070910	12:56	13:50	ORIBF	0.5	Obl.	997	0-507	1.0~0.5	2.5~2.0	22501	36319	1647	3353~3395

KH-07-2 Leg1·3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m³)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
107	N 14-20.9 E142-45.1	N 14-19.2 E142-45.6	070910	15:07	16:03	ORIBF	0.5	Obl.	1028	0-517	1.0~0.5	2.5~2.0	22041	35576	1647	2648~2740
108	N 14-06.1 E142-45.0	N 14-04.5 E142-45.5	070910	17:13	18:06	ORIBF	0.5	Obl.	996	0-506	1.0~0.5	2.5~2.0	20487	33068	1647	2032~2046
109	N 13-51.3 E142-44.8	N 13-51.1 E142-42.8	070910	19:18	20:12	ORIBF	0.5	Obl.	1008	0-503	1.0~0.5	2.5~2.0	20874	33692	1647	1859~1959
110	N 13-51.1 E142-30.1	N 13-52.4 E142-28.5	070910	21:21	22:17	ORIBF	0.5	Obl.	1018	0-504	1.0~0.5	2.5~2.0	21734	35080	1647	2590~2659
111	N 14-06.1 E142-29.9	N 14-07.5 E142-28.2	070910	23:34	24:29	ORIBF	0.5	Obl.	1031	0-500	1.0~0.5	2.5~2.0	21553	34789	1647	2871~3120
112	N 14-20.9 E142-30.1	N 14-22.0 E142-31.6	070911	01:42	02:34	ORIBF	0.5	Obl.	980	0-503	1.0~0.5	2.5~2.0	20888	33715	1647	3586~3652
113	N 14-36.1 E142-30.0	N 14-35.7 E142-31.4	070911	03:50	04:40	ORIBF	0.5	Obl.	965	0-512	1.0~0.5	2.5~2.0	19951	32203	1647	1881~2551
114	N 13-51.1 E142-59.8	N 13-51.1 E143-01.4	070911	08:22	09:18	ORIBF	0.5	Obl.	1028	0-508	1.0~0.5	2.5~2.0	20570	33202	1647	2628~3074
115	N 14-05.7 E143-00.0	N 14-06.3 E143-01.6	070911	10:38	11:33	ORIBF	0.5	Obl.	989	0-521	1.0~0.5	2.5~2.2	21430	34590	1647	3766~3863
116	N 14-21.0 E143-00.0	N 14-21.7 E143-01.5	070911	12:53	13:50	ORIBF	0.5	Obl.	1006	0-499	1.0~0.5	2.5~2.0	20962	33834	1647	1844~1946
117	N 14-35.8 E142-59.8	N 14-36.4 E142-57.9	070911	15:11	16:08	ORIBF	0.5	Obl.	1008	0-510	1.0~0.5	2.5~2.0	22068	35620	1647	2680~2726
118	N 14-35.7 E142-45.0	N 14-33.7 E142-45.0	070911	17:15	18:10	ORIBF	0.5	Obl.	1032	0-510	1.0~0.5	2.5~2.0	23186	37424	1647	3312~3358
119	N 14-21.3 E142-45.0	N 14-19.6 E142-45.1	070911	19:16	20:08	ORIBF	0.5	Obl.	962	0-500	1.0~0.5	2.5~2.0	21125	34098	1647	2658~2868
120	N 14-06.2 E142-45.0	N 14-04.4 E142-45.1	070911	21:19	22:14	ORIBF	0.5	Obl.	972	0-511	1.0~0.5	2.5~2.0	21969	35460	1647	2012~2153
121	N 13-51.2 E142-44.9	N 13-50.2 E142-43.3	070911	23:26	24:19	ORIBF	0.5	Obl.	959	0-508	1.0~0.5	2.5~2.0	19788	31939	1647	1929~2017
122	N 13-51.3 E142-30.1	N 13-52.8 E142-31.8	070912	01:32	02:31	ORIBF	0.5	Obl.	1073	0-504	1.0~0.5	2.5~1.8	25532	41210	1647	2539~2649
123	N 14-06.0 E142-30.1	N 14-07.5 E142-31.6	070912	03:47	04:41	ORIBF	0.5	Obl.	1019	0-509	1.0~0.5	2.5~2.0	23740	38318	1647	3096~3214
124	N 14-21.2 E142-30.0	N 14-23.2 E142-31.2	070912	05:50	06:46	ORIBF	0.5	Obl.	1038	0-497	1.0~0.5	2.5~2.0	24442	39452	1647	3633~3660
125	N 14-36.0 E142-30.0	N 14-37.2 E142-27.7	070912	07:49	08:49	ORIBF	0.5	Obl.	1089	0-506	1.0~0.5	2.5~2.0	25564	41263	1647	2598~3454
126	N 15-05.7 E141-45.0	N 15-03.6 E141-44.8	070912	12:15	13:10	ORIBF	0.5	Obl.	1025	0-501	1.0~0.5	2.5~2.0	23480	37898	1647	4550~4582
127	N 14-50.9 E141-45.0	N 14-49.0 E141-44.7	070912	14:19	15:14	ORIBF	0.5	Obl.	1024	0-503	1.0~0.5	2.5~2.0	22955	37052	1647	4573~4584
128	N 14-36.2 E141-44.9	N 14-34.4 E141-44.7	070912	16:22	17:15	ORIBF	0.5	Obl.	988	0-499	1.0~0.5	2.5~2.0	22332	36046	1647	4595~4602

KH-07-2 Leg1·3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (㎥)	Flow-meter Revol.	Flow-meter No.	Sea Depth (m)
129	N 14-21.4 E141-44.9	N 14-19.5 E141-44.7	070912	18:23	19:16	ORIBF	0.5	Obl.	999	0-499	1.0~0.5	2.5~2.0	22226	35875	1647	4554~4561
130	N 14-06.2 E141-45.0	N 14-04.2 E141-45.0	070912	20:26	21:25	ORIBF	0.5	Obl.	1058	0-509	1.0~0.5	2.5~2.0	24170	39012	1647	4573~4580
131	N 13-51.4 E141-45.1	N 13-51.4 E141-47.2	070912	22:35	23:32	ORIBF	0.5	Obl.	1006	0-509	1.0~0.5	2.5~2.0	22468	36265	1647	4463~4487
132	N 13-51.1 E142-00.1	N 13-51.1 E142-02.0	070913	00:43	01:37	ORIBF	0.5	Obl.	984	0-508	1.0~0.5	2.5~2.0	22323	36031	1647	4073~4148
133	N 14-06.3 E142-00.1	N 14-06.3 E142-02.3	070913	02:57	03:53	ORIBF	0.5	Obl.	1017	0-508	1.0~0.5	2.5~2.0	23922	38612	1647	4346~4369
134	N 14-21.3 E142-00.0	N 14-23.1 E141-58.5	070913	05:08	06:03	ORIBF	0.5	Obl.	1003	0-493	1.0~0.5	2.5~2.0	22794	36792	1647	4315~4352
135	N 14-36.1 E141-59.9	N 14-38.0 E141-58.8	070913	07:10	08:03	ORIBF	0.5	Obl.	1004	0-499	1.0~0.5	2.0	21677	34988	1647	4336~4346
136	N 14-50.9 E141-59.9	N 14-51.2 E141-57.7	070913	09:14	10:11	ORIBF	0.5	Obl.	1031	0-507	1.0~0.5	2.5~2.0	22001	35512	1647	4485~4496
137	N 15-05.9 E142-00.1	N 15-04.6 E141-58.8	070913	11:32	12:27	ORIBF	0.5	Obl.	974	0-501	1.0~0.5	2.5~2.0	22333	36047	1647	4487~4515
138	N 15-05.9 E142-14.8	N 15-04.5 E142-13.7	00913	13:56	14:54	ORIBF	0.5	Obl.	1030	0-507	1.0~0.5	2.5~2.0	22090	35655	1647	4378~4400
139	N 14-51.2 E142-15.1	N 14-49.8 E142-15.0	070913	16:09	17:02	ORIBF	0.5	Obl.	984	0-499	1.0~0.5	2.5~2.0	19362	31252	1647	4334~4403
140	N 14-36.5 E142-14.9	N 14-35.2 E142-14.7	070913	18:15	19:09	ORIBF	0.5	Obl.	1005	0-507	1.0~0.5	2.5~2.0	18425	29740	1647	4087~4133
141	N 14-21.4 E142-15.0	N 14-20.8 E142-13.4	070913	20:29	21:24	ORIBF	0.5	Obl.	945	0-513	1.0~0.5	2.5~2.0	19829	32006	1647	4026~4060
142	N 14-06.4 E142-15.1	N 14-04.9 E142-15.9	070913	22:42	23:38	ORIBF	0.5	Obl.	1007	0-506	1.0~0.5	2.5~2.0	22176	35794	1647	3572~3867
143	N 13-51.0 E142-15.0	N 13-50.5 E142-16.7	070914	01:02	01:56	ORIBF	0.5	Obl.	979	0-504	1.0~0.5	2.5~2.0	21393	34530	1647	3219~3510
144	N 13-50.9 E142-30.1	N 13-50.4 E142-31.9	070914	03:12	04:09	ORIBF	0.5	Obl.	1047	0-505	1.0~0.5	2.5~2.0	24348	39300	1647	2353~2577
145	N 14-06.1 E142-30.1	N 14-07.7 E142-29.0	070914	05:30	06:22	ORIBF	0.5	Obl.	967	0-495	1.0~0.5	2.5	20290	32750	1647	3131~3147
146	N 14-21.1 E142-30.0	N 14-22.8 E142-29.8	070914	07:33	08:25	ORIBF	0.5	Obl.	992	0-511	1.0~0.5	2.5~2.0	18985	30644	1647	3659~3689
147	N 14-35.8 E142-29.9	N 14-37.6 E142-29.4	070914	09:35	10:27	ORIBF	0.5	Obl.	931	0-501	1.0~0.5	2.5~2.2	20490	33073	1647	2671~3075
148	N 14-50.7 E142-30.1	N 14-52.7 E142-30.2	070914	11:38	12:31	ORIBF	0.5	Obl.	937	0-501	1.0~0.5	2.5~2.2	21791	35173	1647	4121~4155
149	N 15-05.9 E142-30.2	N 15-04.2 E142-31.3	070914	13:47	14:41	ORIBF	0.5	Obl.	1026	0-507	1.0~0.5	2.5~2.0	24057	38830	1647	3973~4053
151	N 14-51.3 E142-44.8	N 14-49.3 E142-44.7	070914	16:08	17:02	ORIBF	0.5	Obl.	1021	0-507	1.0~0.5	2.5~1.5	24161	38998	1647	3553~3701

KH-07-2 Leg1・3 Net Record (IKMT, ORIBF, NORPAC)

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.	Flow-	Flow-	Sea
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m³)	meter Revol.	meter No.	Depth (m)
152	N 14-36.2 E142-44.9	N 14-34.5 E142-44.3	070914	18:11	19:03	ORIBF	0.5	Obl.	976	0-505	1.0~0.5	2.5~2.0	21537	34763	1647	3362~3382
153	N 14-21.1 E142-44.9	N 14-19.0 E142-45.4	070914	20:11	21:13	ORIBF	0.5	Obl.	1112	0-510	1.0~0.5	2.5~2.0	25725	41523	1647	2649~2828
154	N 14-06.0 E142-45.0	N 14-04.1 E142-45.8	070914	22:22	23:21	ORIBF	0.5	Obl.	1082	0-516	1.0~0.5	2.5~2.0	25431	41047	1647	1992~2050
155	N 13-50.9 E142-45.1	N 13-50.0 E142-46.6	070915	00:34	01:27	ORIBF	0.5	Obl.	1007	0-514	1.0~0.5	2.5~2.0	22211	35850	1647	2370~3596

*: by Depth Meter

KH-07-2_Leg3	St46	Depth	4776m
Date:	2007/9/2	Lat.	19 59.96N
Time:	09:49	Long.	139 59.87E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
1	29.707	34.449	3.97	0.012
2	29.676	34.444	3.96	0.012
3	29.680	34.444	3.97	0.012
4	29.704	34.449	3.96	0.011
5	29.695	34.448	3.97	0.012
10	29.596	34.431	3.97	0.012
20	29.543	34.432	3.97	0.013
30	28.944	34.775	4.10	0.017
40	27.422	34.815	4.28	0.015
50	26.717	34.873	4.34	0.021
75	23.918	35.057	4.43	0.049
100	21.377	34.935	4.34	0.104
125	20.100	34.880	4.18	0.190
150	19.114	34.845	4.13	0.074
175	18.594	34.828	4.13	0.040
200	18.060	34.816	4.09	0.019
203	17.981	34.815	4.08	0.017

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	29.7	***	***	***
1	199	200	18.017	34.816	4.08	0.018
2	199	200	18.019	34.816	4.09	0.021
3	200	201	17.998	34.816	4.09	0.019
4	199	201	17.988	34.815	4.08	0.019
5	148	148	19.081	34.841	4.11	0.064
6	125	125	20.119	34.889	4.13	0.147
7	124	125	20.126	34.888	4.13	0.159
8	99	100	21.644	34.958	4.31	0.086
9	74	75	23.906	35.049	4.41	0.050
10	49	49	26.677	34.876	4.34	0.019
11	39	39	27.446	34.816	4.27	0.013
12	30	30	28.503	34.782	4.14	0.015
13	19	19	29.505	34.449	3.97	0.014
14	10	11	29.708	34.448	3.95	0.013
15	11	11	29.731	34.451	3.96	0.012
16	11	11	29.727	34.451	3.95	0.011
17	10	10	29.716	34.451	3.96	0.014
18	5	5	29.724	34.452	3.96	0.011
19	113	114	20.675	34.895	4.29	0.231
20	113	113	20.671	34.895	4.29	0.231
21	114	114	20.670	34.896	4.28	0.230
22	145	146	19.191	34.846	4.12	0.075
23	145	146	19.224	34.846	4.13	0.079
24	145	146	19.185	34.845	4.13	0.074

KH-07-2_Leg3	St47	Depth	4240m
Date:	2007/9/2	Lat.	18 59.64N
Time:	14:44	Long.	140 00.20E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
2	29.842	34.633	3.95	0.009
3	29.842	34.633	3.95	0.010
4	29.841	34.633	3.95	0.008
5	29.842	34.633	3.95	0.010
10	29.846	34.633	3.94	0.010
20	29.548	34.609	3.96	0.012
30	29.467	34.608	3.97	0.014
40	29.395	34.607	3.97	0.011
50	28.255	34.767	4.18	0.018
75	25.712	34.864	4.38	0.040
100	23.404	34.914	4.11	0.136
125	21.952	34.941	3.83	0.103
150	20.966	34.934	3.81	0.051
175	19.240	34.848	4.12	0.031
200	18.669	34.818	4.20	0.018
250	17.543	34.788	4.11	0.007
300	15.763	34.653	3.98	0.005
400	12.664	34.403	3.83	0.005
500	9.105	34.180	3.23	0.009
504	9.014	34.181	3.18	0.010

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	29.7	***	***	***
1	200	201	18.698	34.816	4.18	0.009
2	200	202	18.697	34.816	4.18	0.008
3	201	202	18.689	34.817	4.19	0.010
4	200	202	18.695	34.817	4.19	0.008
5	200	202	18.693	34.817	4.18	0.008
6	201	203	18.681	34.817	4.19	0.010
7	149	150	20.549	34.924	3.79	0.027
8	149	150	20.612	34.924	3.79	0.029
9	149	150	20.630	34.925	3.79	0.029
10	150	151	20.611	34.926	3.78	0.028
11	100	101	23.068	34.929	3.91	0.148
12	100	101	23.298	34.915	4.03	0.144
13	101	102	23.258	34.917	4.02	0.140
14	101	101	23.370	34.911	4.04	0.134
15	51	52	27.905	34.779	4.21	0.017
16	51	51	27.926	34.779	4.21	0.019
17	51	51	27.960	34.778	4.21	0.018
18	50	51	28.048	34.776	4.19	0.015
19	41	41	28.862	34.751	4.10	0.012
20	41	41	28.936	34.751	4.09	0.013
21	41	41	28.951	34.752	4.08	0.014
22	6	6	29.814	34.628	3.95	0.025
23	6	6	29.811	34.629	3.95	0.007
24	6	6	29.815	34.630	3.95	0.008

	Leak		Miss Fire	N.D.	No Data

KH-07-2_Leg3	St49	Depth	5201m
Date:	2007/9/2	Lat.	17 59.94N
Time:	22:21	Long.	140 00.03E

CTD data (LAY)

Pres.	Temp.	Sal	DO	Flu.
db	℃	(psu)	ml·l⁻¹	ug/l
1	29.946	34.243	3.95	0.009
2	29.948	34.243	3.95	0.009
3	29.948	34.243	3.95	0.011
4	29.949	34.243	3.95	0.010
5	29.949	34.243	3.95	0.011
10	29.950	34.243	3.94	0.008
20	29.909	34.236	3.96	0.012
30	29.808	34.222	3.97	0.014
40	29.762	34.215	3.97	0.017
50	29.729	34.249	3.99	0.017
75	28.659	34.518	4.16	0.027
100	27.751	34.677	4.15	0.042
125	26.958	34.813	4.03	0.097
150	25.779	34.960	3.86	0.090
175	24.795	34.985	3.77	0.044
200	22.268	34.963	3.83	0.020
250	18.546	34.852	3.99	0.008
300	16.903	34.745	4.07	0.005
400	12.032	34.361	3.18	0.011
500	8.616	34.241	2.35	0.015
507	8.458	34.236	2.32	0.014

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	Flu.
No.	m	db	℃	(psu)	ml·l⁻¹	ug/l
Sur.	0	***	29.9	***	***	***
1	199	200	22.352	34.967	3.81	0.004
2	198	200	22.251	34.963	3.80	0.005
3	198	200	22.214	34.962	3.81	0.007
4	198	199	22.216	34.962	3.81	0.005
5	198	199	22.212	34.962	3.81	0.005
6	198	200	22.206	34.963	3.81	0.007
7	150	151	25.630	34.968	3.83	0.049
8	151	152	25.603	34.967	3.82	0.049
9	152	153	25.476	34.978	3.82	0.045
10	153	154	25.486	34.975	3.81	0.042
11	99	99	27.749	34.675	4.13	0.034
12	99	100	27.747	34.675	4.13	0.035
13	99	100	27.734	34.676	4.13	0.035
14	100	100	27.708	34.677	4.15	0.035
15	49	50	29.729	34.230	3.99	0.017
16	49	50	29.728	34.233	3.98	0.013
17	49	50	29.728	34.232	3.98	0.017
18	49	50	29.728	34.229	3.98	0.016
19	39	40	29.775	34.218	3.97	0.012
20	40	40	29.777	34.218	3.97	0.012
21	40	40	29.777	34.218	3.97	0.012
22	5	5	29.947	34.242	3.95	0.008
23	5	5	29.943	34.242	3.94	0.009
24	5	5	29.946	34.242	3.94	0.010

KH-07-2_Leg3	St51	Depth	4520m
Date:	2007/9/3	Lat.	16 59.60N
Time:	05:27	Long.	139 59.79E

CTD data (LAY)

Pres.	Temp.	Sal	DO	Flu.
db	℃	(psu)	ml·l⁻¹	ug/l
1	30.295	34.375	3.95	0.010
2	30.277	34.375	3.95	0.010
3	30.271	34.376	3.96	0.010
4	30.286	34.375	3.96	0.008
5	30.234	34.377	3.96	0.010
10	30.204	34.378	3.96	0.010
20	30.003	34.371	3.99	0.013
30	29.925	34.418	3.97	0.016
40	29.850	34.412	3.98	0.018
50	29.807	34.418	3.99	0.021
75	28.317	34.692	4.27	0.042
100	27.419	34.787	4.23	0.067
125	26.402	34.914	4.01	0.147
150	25.038	35.021	3.77	0.101
175	23.115	34.965	3.91	0.046
200	21.586	34.979	3.78	0.020
250	18.546	34.849	4.01	0.011
300	16.740	34.726	4.00	0.005
400	12.447	34.385	3.77	0.006
500	8.589	34.202	2.56	0.013
506	8.416	34.200	N.D.	0.016

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	Flu.
No.	m	db	℃	(psu)	ml·l⁻¹	ug/l
Sur.	0	***	30.4	***	***	***
1	198	199	21.593	34.973	3.76	0.012
2	199	200	21.590	34.974	3.77	0.009
3	200	201	21.584	34.974	3.76	0.009
4	200	202	21.588	34.975	3.77	0.008
5	201	202	21.571	34.975	3.77	0.008
6	201	202	21.578	34.975	3.76	0.005
7	147	148	25.228	35.015	3.78	0.069
8	148	149	25.223	35.015	3.78	0.073
9	148	149	25.230	35.015	3.78	0.072
10	148	149	25.232	35.015	3.78	0.075
11	101	102	27.050	34.805	4.18	0.061
12	101	102	27.048	34.805	4.18	0.063
13	103	104	26.970	34.810	4.17	0.065
14	99	99	27.060	34.806	4.19	0.072
15	49	49	29.810	34.423	4.01	0.023
16	50	50	29.806	34.424	4.00	0.020
17	50	50	29.808	34.423	4.01	0.020
18	50	50	29.812	34.423	4.00	0.022
19	40	40	29.872	34.410	3.97	0.024
20	39	40	29.862	34.410	3.97	0.016
21	40	40	29.871	34.410	3.97	0.015
22	5	5	30.164	34.392	3.94	0.010
23	4	4	30.170	34.391	3.94	0.014
24	4	4	30.154	34.394	3.95	0.011

(blank box)	Leak
(blank box)	Miss Fire
N.D.	No Data

KH-07-2_Leg3	St53	Depth	5144m
Date:	2007/9/3	Lat.	16 00.33N
Time:	12:25	Long.	139 59.91E

CTD data (LAY)	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
	1	30.478	34.059	3.95	0.012
	2	30.164	34.033	3.94	0.015
	3	30.156	34.039	3.95	0.014
	4	30.162	34.038	3.95	0.013
	5	30.183	34.034	3.95	0.015
	10	30.065	34.105	3.96	0.018
	20	29.870	34.100	3.98	0.015
	30	29.756	34.158	3.98	0.019
	40	29.832	34.265	3.99	0.021
	50	30.211	34.570	3.98	0.023
	75	28.470	34.697	4.25	0.039
	100	27.400	34.851	4.12	0.085
	125	26.336	34.927	3.97	0.157
	150	24.749	35.045	3.76	0.057
	175	22.317	35.039	3.59	0.022
	200	20.627	34.962	3.55	0.015
	250	17.033	34.696	3.42	0.011
	300	13.847	34.465	3.17	0.009
	400	10.198	34.270	2.82	0.010
	500	7.577	34.196	2.13	0.013
	504	7.527	34.201	2.09	0.015

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	30.5	***	***	***
1	198	200	21.080	34.986	3.52	0.008
2	198	200	21.082	34.987	3.53	0.005
3	199	200	21.081	34.988	3.53	0.004
4	199	200	21.072	34.988	3.53	0.006
5	199	200	21.078	34.988	3.54	0.005
6	199	200	21.076	34.989	3.54	0.005
7	149	150	25.053	35.031	3.75	0.033
8	150	151	25.004	35.037	3.76	0.032
9	149	150	25.087	35.032	3.76	0.035
10	150	151	25.057	35.034	3.76	0.033
11	100	100	27.449	34.839	4.12	0.050
12	100	100	27.449	34.840	4.12	0.053
13	99	100	27.453	34.840	4.14	0.051
14	100	100	27.447	34.841	4.13	0.049
15	50	50	29.922	34.326	3.99	0.016
16	50	50	29.920	34.324	3.99	0.019
17	50	50	29.910	34.319	3.99	0.017
18	50	50	29.908	34.318	3.98	0.017
19						
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23						
24						

KH-07-2_Leg3	St55	Depth	4930m
Date:	2007/9/3	Lat.	14 59.85N
Time:	19:31	Long.	140 00.02E

CTD data (LAY)	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
	1	30.100	34.012	3.94	0.008
	2	30.103	34.012	3.96	0.013
	3	30.104	34.013	3.95	0.014
	4	30.108	34.014	3.95	0.016
	5	30.108	34.015	3.96	0.014
	10	30.095	34.015	3.96	0.011
	20	29.913	34.049	4.00	0.016
	30	29.948	34.170	4.04	0.021
	40	29.587	34.383	4.13	0.026
	50	29.091	34.401	4.15	0.025
	75	28.185	34.578	4.15	0.037
	100	27.132	34.750	4.02	0.079
	125	26.250	34.949	3.93	0.161
	150	24.835	34.966	3.75	0.073
	175	21.880	34.859	3.39	0.029
	200	19.966	34.802	3.22	0.024
	250	15.401	34.587	3.44	0.008
	300	12.425	34.383	3.37	0.007
	400	8.509	34.215	2.53	0.014
	500	7.027	34.320	1.45	0.016
	502	7.013	34.321	1.44	0.019

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	30.1	***	***	***
1	198	199	19.899	34.797	3.19	0.006
2	198	199	19.967	34.797	3.18	0.006
3	198	199	20.110	34.795	3.16	0.009
4	198	199	20.074	34.795	3.16	0.007
5	198	200	20.091	34.796	3.16	0.007
6	198	200	20.058	34.796	3.16	0.004
7	148	149	25.022	34.935	3.70	0.030
8	148	149	25.044	34.935	3.71	0.035
9	149	150	25.064	34.934	3.71	0.033
10	149	150	25.006	34.935	3.72	0.032
11	101	101	27.038	34.755	3.98	0.055
12	100	101	27.082	34.752	4.00	0.052
13	100	100	27.069	34.754	4.01	0.050
14	100	100	27.124	34.747	4.01	0.046
15	49	49	29.242	34.405	4.12	0.017
16	50	51	29.213	34.400	4.13	0.014
17	51	51	29.184	34.395	4.13	0.017
18	51	51	29.185	34.396	4.13	0.018
19	40	40	29.745	34.352	4.11	0.022
20	40	40	29.852	34.337	4.11	0.022
21	40	40	29.822	34.342	4.11	0.022
22	4	4	30.093	34.036	3.96	0.012
23	6	6	30.047	34.049	3.96	0.013
24	6	6	30.050	34.047	3.97	0.011

	Leak		Miss Fire	N.D.	No Data

KH-07-2_Leg3	St57	Depth	5026m		
Date:	2007/9/4	Lat.	13 59.95N		
Time:	02:35	Long.	139 59.81E		
CTD data (LAY)	Pres.	Temp.	Sal	DO	Flu.
	db	℃	(psu)	ml·l^{-1}	ug/l
	2	30.224	33.986	3.95	0.004
	3	30.205	33.986	3.96	0.004
	4	30.175	33.982	3.95	0.004
	5	30.178	33.984	3.95	0.003
	10	30.021	33.980	3.97	0.004
	20	29.995	34.049	3.97	0.007
	30	29.951	34.091	3.99	0.011
	40	29.875	34.097	3.99	0.015
	50	29.749	34.311	4.10	0.017
	75	28.225	34.586	4.15	0.036
	100	27.504	34.878	4.15	0.073
	125	26.907	34.971	4.07	0.113
	150	25.639	35.046	3.90	0.149
	175	23.564	35.019	3.65	0.059
	200	20.801	34.817	3.24	0.034
	250	15.502	34.595	3.49	0.011
	300	13.259	34.447	3.42	0.008
	400	9.098	34.313	2.10	0.014
	500	7.563	34.401	1.53	0.017

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	Flu. ug/l
Sur.	0	***	30.5	***	***	***
1	199	200	20.506	34.802	3.14	0.013
2	199	201	20.556	34.806	3.15	0.016
3	199	201	20.587	34.807	3.14	0.013
4	200	201	20.555	34.807	3.15	0.014
5	199	201	20.544	34.808	3.15	0.013
6	199	200	20.554	34.807	3.14	0.013
7	150	151	25.354	35.041	3.80	0.070
8	150	151	25.316	35.043	3.82	0.068
9	149	150	25.362	35.044	3.83	0.071
10	149	150	25.396	35.045	3.84	0.074
11	99	100	27.546	34.876	4.14	0.045
12	99	100	27.550	34.875	4.14	0.042
13	100	100	27.552	34.875	4.15	0.044
14	100	100	27.552	34.874	4.15	0.045
15	50	50	29.829	34.194	4.05	0.014
16	50	50	29.841	34.174	4.03	0.015
17	51	51	29.846	34.175	4.03	0.015
18	50	51	29.849	34.156	4.03	0.011
19	40	40	29.892	34.095	3.99	0.012
20	40	41	29.898	34.095	3.99	0.012
21	40	40	29.900	34.094	3.98	0.012
22	5	5	29.993	33.982	3.97	0.004
23	5	5	30.029	33.978	3.97	0.003
24	6	6	29.993	33.982	3.97	0.005

KH-07-2_Leg3	St59	Depth	4861m		
Date:	2007/9/4	Lat.	12 59.93N		
Time:	09:58	Long.	139 59.99E		
CTD data (LAY)	Pres.	Temp.	Sal	DO	Flu.
	db	℃	(psu)	ml·l^{-1}	ug/l
	1	30.395	34.026	3.96	0.009
	2	30.428	34.027	3.96	0.012
	3	30.393	34.024	3.96	0.009
	4	30.336	34.019	3.96	0.010
	5	30.353	34.025	3.96	0.012
	10	30.274	34.021	3.97	0.013
	20	30.007	33.999	3.98	0.016
	30	29.842	34.020	4.02	0.014
	40	29.741	34.137	4.07	0.016
	50	29.595	34.308	4.13	0.023
	75	28.953	34.447	4.16	0.026
	100	27.457	34.847	4.15	0.068
	125	26.376	34.981	3.98	0.190
	150	23.521	35.042	3.69	0.082
	175	20.948	34.908	3.43	0.037
	200	17.636	34.710	3.15	0.020
	250	15.096	34.559	3.08	0.015
	300	12.267	34.389	3.08	0.012
	400	8.742	34.401	1.64	0.018
	500	7.792	34.498	1.22	0.021
	502	7.769	34.498	1.22	0.022

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	Flu. ug/l
Sur.	0	***	30.5	***	***	***
1	198	199	17.264	34.684	3.03	0.008
2	197	198	17.296	34.683	3.02	0.011
3	200	202	17.129	34.689	3.08	0.006
4	200	201	17.216	34.687	3.07	0.007
5	199	200	17.211	34.687	3.07	0.008
6	199	200	17.210	34.687	3.07	0.007
7	149	150	23.114	35.051	3.58	0.033
8	150	151	23.081	35.049	3.59	0.035
9	150	151	23.079	35.052	3.58	0.031
10	151	152	23.046	35.053	3.59	0.029
11	99	100	27.185	34.880	4.09	0.051
12	99	100	27.222	34.874	4.09	0.049
13	99	100	27.230	34.873	4.09	0.051
14	100	100	27.228	34.872	4.09	0.055
15	50	51	29.544	34.320	4.13	0.015
16	50	51	29.551	34.327	4.13	0.015
17	51	51	29.545	34.327	4.13	0.015
18	50	51	29.550	34.319	4.13	0.017
19						
20						
21						
22						
23						
24						

(blank box)	Leak
(blank box)	Miss Fire
N.D.	No Data

KH-07-2_Leg3	St60	Depth	3002m		
Date:	2007/9/4	Lat.	14 15.09N		
Time:	22:50	Long.	142 36.65E		
CTD data (LAY)	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
	1	30.006	34.511	3.95	0.013
	2	30.007	34.511	3.94	0.004
	3	30.007	34.511	3.94	0.010
	4	30.002	34.511	3.95	0.011
	5	30.000	34.511	3.95	0.010
	10	29.999	34.511	3.95	0.011
	20	29.944	34.505	3.96	0.014
	30	29.886	34.505	3.96	0.014
	40	29.863	34.505	3.97	0.016
	50	29.826	34.686	4.05	0.019
	75	28.171	34.756	4.20	0.030
	100	26.936	34.855	4.07	0.071
	125	26.051	34.972	3.95	0.145
	150	24.742	35.089	3.81	0.070
	175	22.193	35.020	3.58	0.033
	200	19.648	34.876	3.46	0.020
	250	14.708	34.534	3.19	0.011
	300	12.249	34.395	2.94	0.008
	400	9.126	34.318	2.14	0.015
	500	7.860	34.467	1.35	0.021
	502	7.855	34.467	1.34	0.020

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	30.3	***	***	***
1	149	150	24.565	35.072	3.76	0.027
2	119	120	26.075	34.969	3.94	0.098
3	199	200	19.914	34.901	3.45	0.007
4	200	201	19.870	34.897	3.45	0.007
5	200	201	19.855	34.895	3.44	0.007
6	200	201	19.845	34.894	3.44	0.007
7	149	150	24.550	35.065	3.74	0.024
8	151	151	24.496	35.068	3.75	0.026
9	152	153	24.337	35.071	3.74	0.023
10	149	150	24.548	35.069	3.75	0.025
11	99	100	26.767	34.903	4.04	0.066
12	99	100	26.771	34.902	4.04	0.071
13	100	100	26.782	34.900	4.04	0.073
14	100	100	26.777	34.900	4.05	0.073
15	50	50	29.673	34.754	4.10	0.020
16	50	51	29.642	34.760	4.11	0.020
17	50	51	29.655	34.758	4.11	0.021
18	50	50	29.620	34.763	4.11	0.018
19	89	90	27.136	34.829	4.08	0.059
20	89	90	27.148	34.827	4.08	0.060
21	60	60	28.938	34.766	4.18	0.026
22	60	60	28.826	34.763	4.19	0.025
23	29	29	29.878	34.501	3.97	0.014
24	29	29	29.880	34.501	3.96	0.013

KH-07-2_Leg3	St61	Depth	2369m		
Date:	2007/9/5	Lat.	14 30.22N		
Time:	06:52	Long.	142 52.00E		
CTD data (LAY)	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
	1	30.219	34.171	3.95	0.012
	2	30.196	34.169	3.94	0.013
	3	30.186	34.167	3.95	0.011
	4	30.179	34.167	3.96	0.011
	5	30.179	34.167	3.95	0.011
	10	30.147	34.167	3.97	0.012
	20	30.059	34.199	3.96	0.012
	30	30.023	34.212	3.97	0.014
	40	30.019	34.230	3.97	0.018
	50	29.949	34.221	3.97	0.021
	75	28.903	34.506	4.12	0.034
	100	27.932	34.521	4.14	0.069
	125	26.466	34.782	4.04	0.156
	150	25.092	35.059	3.85	0.085
	175	23.312	35.020	3.68	0.051
	200	20.492	34.916	3.50	0.027
	250	15.830	34.604	3.25	0.013
	300	12.605	34.416	2.95	0.009
	400	9.203	34.293	2.30	0.016
	500	8.154	34.375	1.63	0.018
	503	8.108	34.381	1.58	0.018

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	30.4	***	***	***
1	149	150	25.097	35.056	3.83	0.032
2	120	121	26.726	34.725	4.05	0.078
3	198	200	20.258	34.900	3.42	0.011
4	198	200	20.249	34.900	3.42	0.006
5	198	199	20.212	34.897	3.42	0.007
6	199	200	20.153	34.897	3.43	0.007
7	149	150	25.017	35.059	3.81	0.031
8	149	150	25.109	35.059	3.81	0.034
9	149	150	25.132	35.064	3.82	0.034
10	149	150	25.128	35.060	3.82	0.034
11	100	101	28.145	34.496	4.12	0.031
12	100	101	28.119	34.500	4.12	0.031
13	99	100	28.199	34.492	4.13	0.034
14	100	100	28.179	34.495	4.12	0.035
15	50	50	29.977	34.232	3.96	0.016
16	50	50	29.992	34.235	3.97	0.017
17	50	51	29.989	34.234	3.97	0.018
18	50	51	29.991	34.235	3.96	0.018
19	89	90	28.600	34.504	4.11	0.031
20	89	90	28.601	34.505	4.12	0.031
21	60	60	29.942	34.317	3.99	0.018
22	60	60	29.962	34.309	4.00	0.017
23	30	30	30.023	34.207	3.97	0.013
24	30	30	30.025	34.207	3.97	0.014

(blank box)	Leak
(blank box)	Miss Fire
N.D.	No Data

KH-07-2_Leg3	St62	Depth	3242m
Date:	2007/9/5	Lat.	14 00.07N
Time:	09:51	Long.	142 52.00E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
1	30.442	34.136	3.97	0.016
2	30.351	34.132	3.96	0.012
3	30.357	34.132	3.96	0.013
4	30.349	34.131	3.96	0.011
5	30.335	34.131	3.96	0.013
10	30.091	34.127	3.97	0.012
20	29.997	34.134	3.98	0.016
30	29.895	34.154	3.97	0.019
40	29.872	34.152	3.98	0.022
50	29.858	34.204	4.00	0.025
75	29.697	34.591	4.09	0.034
100	27.373	34.720	4.10	0.083
125	25.901	34.790	3.99	0.193
150	23.752	34.968	3.72	0.080
175	21.719	34.943	3.52	0.045
200	20.083	34.900	3.47	0.025
250	14.833	34.542	3.18	0.010
300	12.131	34.390	2.88	0.010
400	9.256	34.356	1.95	0.015
500	7.708	34.462	1.38	0.018
503	7.650	34.461	1.38	0.018

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	30.4	***	***	***
1	199	200	19.831	34.881	3.41	0.007
2	199	200	19.818	34.880	3.41	0.009
3	199	201	19.652	34.873	3.41	0.009
4	200	201	19.571	34.865	3.43	0.008
5	199	200	19.688	34.871	3.42	0.007
6	199	200	19.710	34.872	3.40	0.008
7	149	150	23.664	34.958	3.66	0.034
8	150	150	23.645	34.960	3.68	0.035
9	150	151	23.671	34.963	3.68	0.036
10	150	151	23.665	34.964	3.68	0.035
11	99	100	27.379	34.715	4.08	0.040
12	99	100	27.361	34.718	4.08	0.037
13	99	100	27.430	34.706	4.08	0.032
14	99	100	27.477	34.700	4.09	0.031
15	49	50	29.872	34.185	3.97	0.016
16	49	50	29.873	34.186	3.97	0.018
17	49	50	29.864	34.184	3.97	0.019
18	49	50	29.870	34.183	3.97	0.017
19						
20						
21						
22						
23						
24						

KH-07-2_Leg3	St63	Depth	3940m
Date:	2007/9/5	Lat.	14 15.07N
Time:	12:04	Long.	143 07.07E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
1	30.113	33.891	3.94	0.010
2	30.115	33.891	3.94	0.011
3	30.117	33.891	3.95	0.009
4	30.101	33.891	3.95	0.011
5	30.071	33.892	3.95	0.011
10	29.970	33.893	3.96	0.010
20	29.846	33.881	3.96	0.012
30	29.827	33.936	3.98	0.015
40	29.993	34.171	3.96	0.025
50	29.810	34.144	3.99	0.024
75	29.005	34.268	4.09	0.036
100	27.995	34.673	4.16	0.078
125	27.017	34.916	4.09	0.105
150	24.928	35.072	3.84	0.095
175	21.626	34.943	3.54	0.045
200	19.948	34.872	3.43	0.020
250	16.631	34.662	3.30	0.013
300	12.830	34.416	3.06	0.009
400	9.393	34.299	2.31	0.013
500	7.799	34.440	1.42	0.017

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO $ml \cdot l^{-1}$	Flu. ug/l
Sur.	0	***	30.1	***	***	***
1	149	150	25.294	35.026	3.84	0.055
2	119	119	27.066	34.879	4.06	0.068
3	198	200	20.275	34.893	3.40	0.008
4	199	200	20.282	34.895	3.41	0.008
5	199	200	20.247	34.895	3.41	0.007
6	199	200	20.197	34.892	3.41	0.004
7	149	150	25.306	35.028	3.85	0.057
8	149	150	25.308	35.029	3.85	0.056
9	149	150	25.288	35.033	3.85	0.054
10	149	150	25.288	35.032	3.85	0.056
11	99	100	28.062	34.597	4.13	0.056
12	100	100	28.046	34.618	4.13	0.057
13	100	100	28.008	34.660	4.15	0.060
14	100	101	27.992	34.677	4.15	0.059
15	50	50	29.879	34.165	3.97	0.019
16	49	49	29.899	34.173	3.97	0.022
17	49	49	29.893	34.171	3.97	0.021
18	49	49	29.891	34.171	3.97	0.022
19	89	90	28.415	34.481	4.13	0.043
20	89	89	28.415	34.481	4.12	0.043
21	60	60	29.320	34.163	4.06	0.023
22	60	60	29.317	34.165	4.06	0.024
23	30	31	29.884	33.978	3.98	0.014
24	30	30	29.893	33.985	3.98	0.015

	Leak		Miss Fire	N.D.	No Data

KH-07-2_Leg3	St89		Depth	2644m	
Date:	2007/9/8		Lat.	14 36.09N	
Time:	08:56		Long.	142 29.90E	

CTD data (LAY)	Pres.	Temp.	Sal	DO	Flu.
	db	℃	(psu)	$ml \cdot l^{-1}$	ug/l
	1	30.195	34.112	3.97	0.02
	2	30.196	34.113	3.97	0.01
	3	30.187	34.104	3.97	0.01
	4	30.173	34.090	3.97	0.02
	5	30.164	34.081	3.96	0.02
	10	30.196	34.135	3.97	0.02
	20	30.203	34.174	3.97	0.02
	30	30.134	34.338	3.99	0.02
	40	30.011	34.377	4.00	0.03
	50	29.882	34.412	3.99	0.03
	75	29.349	34.629	4.17	0.04
	100	27.769	34.701	4.16	0.06
	125	26.116	34.985	3.98	0.18
	150	24.675	35.070	3.81	0.08
	175	22.297	35.008	3.61	0.04
	200	19.377	34.849	3.42	0.02

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	Flu.
No.	m	db	℃	(psu)	$ml \cdot l^{-1}$	ug/l
Sur.	0	***	30.1	***	***	***
1	100	100	27.188	34.709	4.08	0.09
2	100	100	26.975	34.764	4.07	0.10
3	100	100	27.089	34.723	4.05	0.10
4	149	150	24.525	35.083	3.76	0.06
5	149	150	24.499	35.085	3.75	0.07
6	150	151	24.539	35.084	3.76	0.07
7	199	200	19.273	34.841	3.39	0.02
8	198	199	19.293	34.841	3.39	0.02
9	198	199	19.281	34.840	3.39	0.02
10	198	199	19.301	34.841	3.38	0.02
11	198	199	19.246	34.839	3.39	0.02
12	50	50	29.865	34.447	4.00	0.03
13	50	50	29.862	34.448	4.00	0.03
14	50	50	29.865	34.449	3.99	0.04
15	75	75	29.111	34.750	4.19	0.04
16	30	31	30.063	34.364	3.99	0.03
17	9	10	30.191	34.157	3.96	0.02
18	9	9	30.192	34.155	3.97	0.02
19	9	9	30.192	34.155	3.96	0.02
20	10	10	30.194	34.150	3.96	0.02
21	119	120	26.170	34.970	3.96	0.16
22	150	151	24.529	35.084	3.77	0.07
23	150	151	24.532	35.086	3.77	0.06
24	150	151	24.520	35.085	3.77	0.07

(box)	Leak
(box)	Miss Fire
N.D.	No Data

XCTD

Cruise	KH-07-2_Leg1	
Date(GMT)	2007/8/9	
Time(GMT)	03:36	
Depth	3446m	
Lat.	15-24.59N	
Long.	142-46.95E	
Depth.	Temp.	Sal
m	℃	(psu)
3	29.631	34.114
4	29.617	34.139
5	29.609	34.145
10	29.588	34.180
20	29.598	34.207
30	29.588	34.212
40	29.588	34.213
50	29.588	34.219
75	29.316	34.576
100	27.399	34.703
125	26.730	34.767
150	26.169	34.834
175	24.227	34.941
200	21.482	34.917
250	17.678	34.670
300	13.946	34.407
400	9.467	34.198
500	7.865	34.264
600	6.803	34.331
700	5.925	34.399
800	5.445	34.442
900	4.969	34.479
1000	4.498	34.503
1100	4.130	34.525

Cruise	KH-07-2_Leg1	
Date(GMT)	2007/8/9	
Time(GMT)	20:18	
Depth	2012m	
Lat.	14-26.97N	
Long.	142-50.87E	
Depth.	Temp.	Sal
m	℃	(psu)
3	29.973	34.117
4	29.975	34.134
5	29.973	34.139
10	29.973	34.150
20	29.974	34.160
30	29.975	34.167
40	30.019	34.251
50	29.725	34.342
75	28.539	34.481
100	27.354	34.713
125	26.497	34.853
150	25.094	34.921
175	22.959	34.946
200	19.853	34.817
250	15.645	34.528
300	11.891	34.304
400	8.791	34.239
500	7.594	34.355
600	6.306	34.393
700	5.753	34.438
800	5.272	34.468
900	4.873	34.487
1000	4.531	34.524

KH-07-2_Leg1								
Station	*Local time*		*Universal time*		*Latitude*	*Longitude*	*Depth*	*Comment*
	3-Aug	18:43	3-Aug	9:43	34 41.904N	139 44.995E	2342	SUNSET
	4-Aug	4:54		19:54	32 00.963N	140 31.659E	2192	SUNRISE
		18:24	4-Aug	9:24	28 35.432N	141 31.221E	4034	SUNSET
	5-Aug	4:57		19:57	25 45.120N	142 10.836E	2796	SUNRISE
T1-1		8:08		23:08	24 56.674N	142 15.808E	2270	IKMT NET STARTED
T1-1		10:08	5-Aug	1:08	24 56.821N	142 22.856E	2148	IKMT NET FINISHED
T1-2		10:20		1:20	24 56.921N	142 23.020E	2130	IKMT NET STARTED
T1-2		11:30		2:30	24 56.795N	142 27.250E	2436	IKMT NET FINISHED
		18:10		9:10	23 17.923N	142 27.432E	2672	SUNSET
	21:00→22:00			12:00	22 32.176N	142 29.477E	2526	PUT SHIPS CLOCKS AH'D 1H
	6-Aug	6:08		20:08	20 21.524N	142 42.303E	1652	SUNRISE
		19:02	6-Aug	9:02	17 05.435N	143 01.806E	2970	SUNSET
		21:15		11:15	16 32.319N	143 07.895E	1721	ABIS STARTED
		23:19		13:19	16 32.339N	143 09.779E	1559	ABIS FINISHED
P1		23:42		13:42	16 34.353N	143 09.159E	1982	IKMT NET STARTED
P1	7-Aug	0:37		14:37	16 32.121N	143 07.755E	1656	IKMT NET FINISHED
		1:04		15:04	16 31.792N	143 09.524E	1260	ABIS STARTED
P4		4:58		18:58	16 30.139N	143 09.535E	446	HOOKING NET STARTED
P4		5:16		19:16	16 30.088N	143 09.721E	639	HOOKING NET FINISHED
		6:09		20:09	16 30.408N	143 08.238E	468	SUNRISE
P6		7:09		21:09	16 30.931N	143 09.219E	456	HOOKING NET STARTED
P6		8:33		22:33	16 30.890N	143 09.191E	404	HOOKING NET FINISHED
P6		9:01		23:01	16 30.967N	143 08.010E	884	IKMT NET STARTED
P6		9:49		23:49	16 30.879N	143 10.360E	974	IKMT NET FINISHED
P7		10:03	7-Aug	0:03	16 30.878N	143 10.507E	1011	IKMT NET STARTED
P7		10:56		0:56	16 31.003N	143 07.329E	0	IKMT NET FINISHED
P8		11:45		1:45	16 35.896N	143 07.794E	1590	IKMT NET STARTED
P8		14:15		4:15	16 27.677N	143 07.763E	1834	IKMT NET FINISHED
		17:57		7:57	15 38.618N	142 46.021E	0	ABIS STARTED
		18:46		8:46	15 37.028N	142 45.519E	679	SUNSET
	8-Aug	0:15		14:15	15 37.047N	142 45.825E	678	ABIS FINISHED
A2		0:44		14:44	15 38.679N	142 44.531E	1132	IKMT NET STARTED
A2		1:43		15:43	15 37.864N	142 45.134E	4234	IKMT NET FINISHED
A2		1:44		15:44	15 37.871N	142 45.129E	0	HOOKING NET STARTED
A2		2:08		16:08	15 38.136N	142 45.067E	465	HOOKING NET FINISHED
A3		2:37		16:37	15 38.431N	142 45.562E	304	HOOKING NET STARTED
A3		2:56		16:56	15 38.534N	142 45.458E	455	HOOKING NET FINISHED
		3:10		17:10	15 39.065N	142 45.927E	811	ABIS STARTED
A4		4:32		18:32	15 40.749N	142 44.250E	2428	IKMT NET STARTED
A4		5:57		19:57	15 35.644N	142 44.401E	4508	IKMT NET FINISHED
		6:12		20:12	15 34.922N	142 44.519E	4201	SUNRISE
S1		12:13	8-Aug	2:13	14 14.355N	142 52.233E	362	ABIS FINISHED
S2		12:31		2:31	14 14.043N	142 52.253E	218	HOOKING NET STARTED
S2		13:04		3:04	14 14.137N	142 52.137E	360	HOOKING NET FINISHED
		13:10		3:10	14 14.039N	142 52.145E	389	ABIS STARTED
		14:07		4:07	14 12.981N	142 52.793E	349	ABIS FINISHED
S5		14:07		4:07	14 12.979N	142 52.797E	358	IKMT NET STARTED
S5		14:31		4:31	14 12.275N	142 53.991E	767	IKMT NET FINISHED
		14:50		4:50	14 13.952N	142 53.973E	625	ABIS STARTED
		15:43		5:43	14 12.857N	142 54.083E	834	ABIS FINISHED
S7		16:12		6:12	14 10.159N	142 51.841E	1432	IKMT NET STARTED
S7		17:47		7:47	14 16.093N	142 52.095E	1550	IKMT NET FINISHED
		17:58		7:58	14 15.620N	142 51.795E	1392	ABIS STARTED
		18:55		8:55	14 11.939N	142 54.382E	1143	SUNSET
		19:44		9:44	14 15.644N	142 51.721E	1374	ABIS FINISHED
S9		19:54		9:54	14 15.534N	142 51.098E	1355	IKMT NET STARTED
S9		20:52		10:52	14 15.597N	142 54.393E	1440	IKMT NET FINISHED
S10		21:18		11:18	14 14.516N	142 55.989E	1765	IKMT NET STARTED
S10		22:49		12:49	14 11.541N	142 52.780E	938	IKMT NET FINISHED
S11		23:18		13:18	14 10.114N	142 53.603E	1615	IKMT NET STARTED
S11	9-Aug	1:00		15:00	14 14.429N	142 51.612E	722	IKMT NET FINISHED
S12		1:46		15:46	14 16.739N	142 50.841E	1877	IKMT NET STARTED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
S12		3:39		17:39	14 13.566N	142 54.897E	1217	IKMT NET FINISHED
S13		4:18		18:18	14 15.817N	142 55.793E	1811	ORI NET STARTED
S13		5:44		19:44	14 13.443N	142 56.485E	1678	ORI NET FINISHED
		6:13		20:13	14 15.240N	142 53.990E	1260	SUNRISE
S14		6:45		20:45	14 16.005N	142 49.592E	1905	ORI NET STARTED
S14		8:42		22:42	14 12.747N	142 50.162E	1593	ORI NET FINISHED
		13:35	9-Aug	3:35	15 24.844N	142 46.911E	3446	LET GO XCTD
		14:32		4:32	15 37.908N	142 45.922E	0	ABIS STARTED AT ARAKANE
		15:10		5:10	15 38.796N	142 46.264E	524	ABIS FINISHED
A7		15:31		5:31	15 38.711N	142 45.953E	480	HOOKING NET STARTED
A7		15:44		5:44	15 38.818N	142 45.829E	637	HOOKING NET FINISHED
A8		16:04		6:04	15 38.432N	142 45.474E	350	HOOKING NET STARTED
A8		16:15		6:15	15 38.517N	142 45.464E	445	HOOKING NET FINISHED
A9		16:34		6:34	15 37.894N	142 45.115E	348	HOOKING NET STARTED
A9		16:53		6:53	15 38.136N	142 45.013E	516	HOOKING NET FINISHED
A12		17:18		7:18	15 37.044N	142 42.591E	2387	IKMT NET STARTED
		18:57		8:57	15 39.728N	142 47.229E	1690	SUNSET
A12		18:57		8:57	15 39.727N	142 47.233E	1711	IKMT NET FINISHED
A13		19:29		9:29	15 40.307N	142 47.358E	2083	IKMT NET STARTED
A13		21:13		11:13	15 36.128N	142 46.031E	1550	IKMT NET FINISHED
A14		21:37		11:37	15 35.057N	142 47.322E	2730	IKMT NET STARTED
A14		23:32		13:32	15 38.886N	142 43.264E	2000	IKMT NET FINISHED
A15		23:52		13:52	15 40.135N	142 42.863E	2572	ORI NET STARTED
A15	10-Aug	1:33		15:33	15 36.786N	142 43.023E	2262	ORI NET FINISHED
		6:14		20:14	14 26.906N	142 50.872E	2120	SUNRISE
		6:18		20:18	14 26.499N	142 50.920E	2012	LET GO XCTD
S15		7:14		21:14	14 15.867N	142 50.516E	1798	IKMT NET STARTED
S15		9:03		23:03	14 11.229N	142 53.220E	1035	IKMT NET FINISHED
S16		9:31		23:31	14 10.611N	142 51.773E	1490	IKMT NET STARTED
S16		10:49	10-Aug	0:49	14 13.012N	142 54.380E	974	IKMT NET FINISHED
S17		11:13		1:13	14 12.643N	142 56.198E	1532	IKMT NET STARTED
S17		13:10		3:10	14 15.953N	142 51.978E	1505	IKMT NET FINISHED
S18		13:29		3:29	14 15.994N	142 51.223E	1689	ORI NET STARTED
S18		15:28		5:28	14 12.176N	142 50.881E	1433	ORI NET FINISHED
S19		15:58		5:58	14 11.728N	142 51.931E	1211	IKMT NET STARTED
S19		17:09		7:09	14 11.763N	142 55.610E	1615	IKMT NET FINISHED
S20		17:27		7:27	14 11.460N	142 54.819E	1486	IKMT NET STARTED
		18:54		8:54	14 15.230N	142 54.480E	1423	SUNSET
S20		19:00		9:00	14 15.406N	142 54.533E	1447	IKMT NET FINISHED
S21		19:10		9:10	14 15.253N	142 54.776E	1540	IKMT NET STARTED
S21		20:25		10:25	14 15.267N	142 51.022E	1357	IKMT NET FINISHED
S22		20:39		10:39	14 15.714N	142 51.145E	1410	IKMT NET STARTED
S22		22:08		12:08	14 11.505N	142 51.211E	1424	IKMT NET FINISHED
S23		22:25		12:25	14 11.385N	142 51.214E	1444	ORI NET STARTED
S23	11-Aug	0:26		14:26	14 15.397N	142 51.238E	1183	ORI NET FINISHED
S24		0:46		14:46	14 15.257N	142 50.939E	1416	IKMT NET STARTED
S24		1:59		15:59	14 15.233N	142 54.660E	1481	IKMT NET FINISHED
S25		2:14		16:14	14 15.592N	142 54.918E	1638	IKMT NET STARTED
S25		3:29		17:29	14 11.869N	142 54.309E	1178	IKMT NET FINISHED
S26		3:53		17:53	14 11.662N	142 54.963E	1462	IKMT NET STARTED
S26		5:07		19:07	14 11.729N	142 50.762E	1484	IKMT NET FINISHED
S27		5:18		19:18	14 11.489N	142 51.064E	1453	IKMT NET STARTED
		6:14		20:14	14 14.795N	142 51.250E	980	SUNRISE
S27		6:39		20:39	14 15.797N	142 51.423E	1493	IKMT NET FINISHED
S28		6:58		20:58	14 15.766N	142 51.525E	1456	ORI NET STARTED
S28		9:13		23:13	14 11.898N	142 51.501E	1308	ORI NET FINISHED
S29		9:35		23:35	14 11.776N	142 50.661E	1503	IKMT NET STARTED
S29		10:54	11-Aug	0:54	14 11.737N	142 54.847E	1329	IKMT NET FINISHED
S30		11:12		1:12	14 11.136N	142 54.438E	1536	IKMT NET STARTED
S30		12:38		2:38	14 15.097N	142 54.520E	1398	IKMT NET FINISHED
S31		12:56		2:56	14 15.179N	142 55.197E	1606	IKMT NET STARTED
S31		14:23		4:23	14 15.296N	142 51.246E	1153	IKMT NET FINISHED
S32		14:38		4:38	14 15.757N	142 51.220E	1510	IKMT NET STARTED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
S32		16:02		6:02	14 11.459N	142 51.306E	1414	IKMT NET FINISHED
S33		16:15		6:15	14 11.277N	142 51.067E	1479	ORI NET STARTED
S33		18:08		8:08	14 14.935N	142 51.474E	0	ORI NET FINISHED
S34		18:26		8:26	14 15.251N	142 50.752E	1513	IKMT NET STARTED
		18:54		8:54	14 15.249N	142 52.788E	1052	SUNSET
S34		19:38		9:38	14 15.241N	142 54.924E	1554	IKMT NET FINISHED
S35		19:51		9:51	14 15.745N	142 54.485E	1465	IKMT NET STARTED
S35		21:06		11:06	14 11.820N	142 54.476E	1144	IKMT NET FINISHED
S36		21:22		11:22	14 11.727N	142 55.030E	1446	IKMT NET STARTED
S36		22:34		12:34	14 11.734N	142 51.481E	1332	IKMT NET FINISHED
S37		22:57		12:57	14 11.216N	142 51.186E	1480	ORI NET STARTED
S37	12-Aug	0:50		14:50	14 14.934N	142 51.252E	1078	ORI NET FINISHED
S38		1:08		15:08	14 15.648N	142 51.404E	1436	IKMT NET STARTED
S38		2:28		16:28	14 11.357N	142 51.336E	1434	IKMT NET FINISHED
S39		2:51		16:51	14 11.663N	142 50.702E	1504	ORI NET STARTED
S39		4:46		18:46	14 11.744N	142 54.538E	1230	ORI NET FINISHED
S40		5:00		19:00	14 11.268N	142 54.726E	1543	IKMT NET STARTED
		6:14		20:14	14 14.659N	142 54.487E	1214	SUNRISE
S40		6:31		20:31	14 15.370N	142 54.521E	1440	IKMT NET FINISHED
S41		6:44		20:44	14 15.334N	142 55.105E	1627	IKMT NET STARTED
S41		8:01		22:01	14 15.257N	142 50.967E	1429	IKMT NET FINISHED
S42		8:22		22:22	14 15.849N	142 51.410E	1577	ORI NET STARTED
S42		10:41	12-Aug	0:41	14 11.556N	142 51.268E	1406	ORI NET FINISHED
S43		11:00		1:00	14 11.346N	142 51.236E	1453	IKMT NET STARTED
S43		12:14		2:14	14 15.065N	142 51.260E	1184	IKMT NET FINISHED
S44		12:29		2:29	14 15.506N	142 51.107E	1314	IKMT NET STARTED
S44		13:47		3:47	14 15.655N	142 55.326E	1708	IKMT NET FINISHED
S45		14:04		4:04	14 15.413N	142 54.708E	1509	IKMT NET STARTED
S45		15:24		5:24	14 11.002N	142 54.440E	1561	IKMT NET FINISHED
S46		15:48		5:48	14 11.662N	142 55.010E	1473	ORI NET STARTED
S46		17:56		7:56	14 11.708N	142 51.839E	1234	ORI NET FINISHED
S47		18:07		8:07	14 11.472N	142 51.360E	1406	ORI NET STARTED
		18:53		8:53	14 12.618N	142 51.232E	1239	SUNSET
S47		20:31		10:31	14 15.325N	142 51.273E	1148	ORI NET FINISHED
S48		20:50		10:50	14 15.680N	142 51.282E	1445	IKMT NET STARTED
S48		22:06		12:06	14 11.333N	142 51.228E	1448	IKMT NET FINISHED
S49		22:24		12:24	14 11.722N	142 50.859E	1472	ORI NET STARTED
S49	13-Aug	0:26		14:26	14 11.496N	142 55.642E	1664	ORI NET FINISHED
S50		0:52		14:52	14 11.271N	142 54.593E	1544	IKMT NET STARTED
S50		2:32		16:32	14 15.301N	142 54.495E	1427	IKMT NET FINISHED
S51		2:48		16:48	14 15.533N	142 55.014E	1650	IKMT NET STARTED
S51		4:14		18:14	14 15.204N	142 50.882E	1413	IKMT NET FINISHED
S52		4:26		18:26	14 15.505N	142 51.259E	1255	ORI NET STARTED
		6:14		20:14	14 11.051N	142 51.187E	1508	SUNRISE
S52		6:27		20:27	14 10.859N	142 50.796E	1552	ORI NET FINISHED
S53		6:44		20:44	14 11.156N	142 51.415E	1458	IKMT NET STARTED
S53		7:58		21:58	14 14.728N	142 51.229E	1011	IKMT NET FINISHED
S54		8:16		22:16	14 15.290N	142 50.671E	1530	ORI NET STARTED
S54		10:11	13-Aug	0:11	14 15.214N	142 54.421E	1394	ORI NET FINISHED
S55		10:31		0:31	14 15.666N	142 54.471E	1460	IKMT NET STARTED
S55		11:57		1:57	14 10.774N	142 54.588E	1666	IKMT NET FINISHED
S56		12:21		2:21	14 11.703N	142 55.017E	1455	ORI NET STARTED
S56		14:30		4:30	14 11.738N	142 50.612E	1510	ORI NET FINISHED
S57		14:49		4:49	14 11.297N	142 51.271E	1456	ORI NET STARTED
S57		17:38		7:38	14 15.480N	142 51.238E	1244	ORI NET FINISHED
S58		17:48		7:48	14 15.775N	142 51.288E	1592	IKMT NET STARTED
		18:56		8:56	14 11.323N	142 51.267E	1444	SUNSET
S58		19:06		9:06	14 10.896N	142 51.250E	1533	IKMT NET FINISHED
S59		19:20		9:20	14 11.572N	142 50.967E	1462	ORI NET STARTED
S59		21:14		11:14	14 11.780N	142 55.178E	1463	ORI NET FINISHED
S60		21:43		11:43	14 11.350N	142 54.467E	1484	IKMT NET STARTED
S60		23:04		13:04	14 15.166N	142 54.518E	1413	IKMT NET FINISHED
S61		23:21		13:21	14 15.262N	142 55.167E	1609	ORI NET STARTED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
S61	14-Aug	1:31		15:31	14 15.258N	142 50.861E	1435	ORI NET FINISHED
S62		1:47		15:47	14 15.605N	142 51.259E	1328	ORI NET STARTED
S62		3:56		17:56	14 10.735N	142 51.445E	1520	ORI NET FINISHED
S63		4:04		18:04	14 10.600N	142 51.280E	1579	IKMT NET STARTED
S63		5:18		19:18	14 14.100N	142 51.228E	1071	IKMT NET FINISHED
		6:14		20:14	14 22.852N	142 50.442E	2444	SUNRISE
St1		9:39		23:39	15 15.933N	142 45.336E	3646	ORI NET STARTED
St1		11:07	14-Aug	1:07	15 12.996N	142 45.049E	3480	ORI NET FINISHED
St2		12:16		2:16	15 00.041N	142 44.905E	3126	ORI NET STARTED
St2		13:25		3:25	14 57.890N	142 44.428E	2598	ORI NET FINISHED
St3		14:29		4:29	14 45.182N	142 45.167E	3616	ORI NET STARTED
St3		15:50		5:50	14 42.950N	142 45.055E	3602	ORI NET FINISHED
St4		16:54		6:54	14 30.059N	142 45.141E	2959	ORI NET STARTED
St4		18:26		8:26	14 26.494N	142 44.235E	2790	ORI NET FINISHED
		18:56		8:56	14 21.134N	142 44.770E	2677	SUNSET
St5		19:21		9:21	14 15.300N	142 45.328E	2256	ORI NET STARTED
St5		20:38		10:38	14 12.226N	142 44.738E	2296	ORI NET FINISHED
St6		21:48		11:48	13 59.867N	142 45.031E	1582	ORI NET STARTED
St6		23:10		13:10	13 57.198N	142 44.353E	1702	ORI NET FINISHED
St7	15-Aug	0:13		14:13	13 45.056N	142 45.095E	3310	ORI NET STARTED
St7		1:38		15:38	13 41.926N	142 46.071E	4398	ORI NET FINISHED
St8		2:41		16:41	13 30.030N	142 45.005E	3132	ORI NET STARTED
St8		4:08		18:08	13 27.794N	142 46.925E	2949	ORI NET FINISHED
St9		5:09		19:09	13 15.090N	142 45.525E	4361	ORI NET STARTED
		6:22		20:22	13 15.853N	142 42.853E	4449	SUNRISE
St9		6:39		20:39	13 15.744N	142 42.282E	4521	ORI NET FINISHED
St10		7:47		21:47	13 22.321N	142 29.993E	2533	ORI NET STARTED
St10		9:03		23:03	13 24.696N	142 29.574E	1852	ORI NET FINISHED
St11		10:12	15-Aug	0:12	13 37.414N	142 29.968E	2776	ORI NET STARTED
St11		11:24		1:24	13 39.712N	142 30.726E	2687	ORI NET FINISHED
St12		12:34		2:34	13 52.482N	142 30.003E	2565	ORI NET STARTED
St12		13:52		3:52	13 54.481N	142 31.986E	2736	ORI NET FINISHED
St13		14:58		4:58	14 07.527N	142 30.040E	3254	ORI NET STARTED
St13		16:10		6:10	14 09.438N	142 31.948E	2811	ORI NET FINISHED
St14		17:14		7:14	14 22.274N	142 29.981E	3670	ORI NET STARTED
St14		18:28		8:28	14 24.596N	142 29.350E	3700	ORI NET FINISHED
		18:53		8:53	14 28.297N	142 29.628E	3662	SUNSET
St15		19:31		9:31	14 37.172N	142 30.253E	2731	ORI NET STARTED
St15		20:40		10:40	14 38.691N	142 28.816E	3513	ORI NET FINISHED
St16		21:52		11:52	14 52.488N	142 30.067E	4150	ORI NET STARTED
St16		22:59		12:59	14 54.300N	142 28.911E	4143	ORI NET FINISHED
St17	16-Aug	0:07		14:07	15 07.372N	142 30.013E	3985	ORI NET STARTED
St17		1:17		15:17	15 09.234N	142 28.682E	4151	ORI NET FINISHED
St18		2:26		16:26	15 22.461N	142 29.900E	4031	ORI NET STARTED
St18		3:32		17:32	15 22.033N	142 27.883E	4082	ORI NET FINISHED
		6:18		20:18	15 15.339N	141 46.558E	4501	SUNRISE
St19		6:29		20:29	15 15.017N	141 45.079E	4524	ORI NET STARTED
St19		7:48		21:48	15 12.264N	141 44.546E	4530	ORI NET FINISHED
St20		8:53		22:53	15 00.075N	141 45.050E	4598	ORI NET STARTED
St20		10:21	16-Aug	0:21	14 57.127N	141 44.654E	4614	ORI NET FINISHED
St21		11:26		1:26	14 44.979N	141 44.997E	4601	ORI NET STARTED
St21		12:55		2:55	14 41.197N	141 43.671E	4614	ORI NET FINISHED
St34		14:31		4:31	14 52.261N	141 59.799E	4517	ORI NET STARTED
St34		15:58		5:58	14 50.084N	141 57.007E	4516	ORI NET FINISHED
St35		17:55		7:55	15 07.305N	141 59.997E	4490	ORI NET STARTED
		18:56		8:56	15 07.785N	141 57.830E	4517	SUNSET
St35		19:23		9:23	15 08.053N	141 56.875E	4543	ORI NET FINISHED
St37		20:59		10:59	15 14.937N	142 15.006E	4320	ORI NET STARTED
St37		22:22		12:22	15 14.308N	142 11.487E	4348	ORI NET FINISHED
St38		23:39		13:39	14 59.696N	142 13.701E	4413	ORI NET STARTED
St38	17-Aug	0:58		14:58	14 57.717N	142 11.507E	4415	ORI NET FINISHED
St39		2:06		16:06	14 45.277N	142 14.868E	4340	ORI NET STARTED
St39		3:29		17:29	14 43.738N	142 11.678E	4320	ORI NET FINISHED
St33		4:34		18:34	14 37.474N	142 00.025E	4350	ORI NET STARTED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
St33		5:54		19:54	14 37.810N	141 57.072E	4402	ORI NET FINISHED
		6:18		20:18	14 36.118N	141 54.193E	4544	SUNRISE
St22		7:03		21:03	14 29.754N	141 44.996E	4580	ORI NET STARTED
St22		8:24		22:24	14 27.756N	141 43.138E	4596	ORI NET FINISHED
St23		9:34		23:34	14 14.960N	141 44.836E	4533	ORI NET STARTED
St23		10:48	17-Aug	0:48	14 15.032N	141 46.656E	4247	ORI NET FINISHED
St32		12:03		2:03	14 22.513N	141 59.964E	4339	ORI NET STARTED
St32		13:17		3:17	14 22.897N	142 01.733E	4284	ORI NET FINISHED
St40		14:33		4:33	14 29.909N	142 14.967E	4123	ORI NET STARTED
St40		15:57		5:57	14 27.848N	142 17.088E	4007	ORI NET FINISHED
St41		16:57		6:57	14 15.096N	142 15.114E	4127	ORI NET STARTED
St41		18:22		8:22	14 13.614N	142 11.945E	4183	ORI NET FINISHED
		18:54		8:54	14 10.689N	142 06.042E	4311	SUNSET
St31		19:23		9:23	14 07.486N	141 59.922E	4377	ORI NET STARTED
St31		20:41		10:41	14 06.191N	141 56.816E	4391	ORI NET FINISHED
St24		21:48		11:48	14 00.080N	141 45.229E	4642	ORI NET STARTED
St24		23:01		13:01	13 58.079N	141 43.359E	4555	ORI NET FINISHED
St25	18-Aug	0:09		14:09	13 45.106N	141 45.036E	4368	ORI NET STARTED
St25		1:21		15:21	13 45.271N	141 47.577E	4303	ORI NET FINISHED
St30		2:34		16:34	13 52.530N	141 59.790E	4173	ORI NET STARTED
St30		3:35		17:35	13 51.841N	141 57.855E	4220	ORI NET FINISHED
St25-2		4:45		18:45	13 44.978N	141 44.923E	4375	ORI NET STARTED
		6:18		20:18	13 42.087N	141 43.054E	4366	SUNRISE
St25-2		6:23		20:23	13 42.003N	141 42.916E	4365	ORI NET FINISHED
St26		7:23		21:23	13 29.957N	141 44.714E	3155	ORI NET STARTED
St26		8:41		22:41	13 30.075N	141 47.358E	2927	ORI NET FINISHED
St29		9:59		23:59	13 37.324N	142 00.104E	3600	ORI NET STARTED
St29		11:07	18-Aug	1:07	13 35.274N	141 58.854E	3712	ORI NET FINISHED
St28		12:12		2:12	13 22.570N	141 59.806E	2937	ORI NET STARTED
St28		13:24		3:24	13 22.598N	142 02.297E	2851	ORI NET FINISHED
St45		14:38		4:38	13 15.016N	142 15.016E	2487	ORI NET STARTED
St45		15:49		5:49	13 15.566N	142 17.724E	2393	ORI NET FINISHED
St44		17:00		7:00	13 29.944N	142 15.221E	3186	ORI NET STARTED
St44		18:11		8:11	13 31.307N	142 13.438E	3198	ORI NET FINISHED
		18:55		8:55	13 40.562N	142 14.455E	3243	SUNSET
St43		19:17		9:17	13 45.158N	142 14.871E	3105	ORI NET STARTED
St43		20:39		10:39	13 46.987N	142 12.333E	3492	ORI NET FINISHED
St42		21:48		11:48	14 00.143N	142 14.809E	3579	ORI NET STARTED
St42		23:15		13:15	14 00.148N	142 17.663E	3243	ORI NET FINISHED
	19-Aug	6:11		20:11	13 33.725N	144 05.898E	3465	SUNRISE

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Station	*Local time*		*Universal time*		*Latitude*	*Longitude*	*Depth*	*Comment*
	1-Sep	18:36	1-Sep	8:36	14 21.390N	143 59.193E	4083	SUNSET
	2-Sep	6:17		20:17	17 00.675N	142 07.435E	4429	SUNRISE
		18:55	2-Sep	8:55	19 51.810N	140 05.964E	4530	SUNSET
St46		19:45		9:45	19 59.974N	139 59.901E	4776	CTD-CMS STARTED
St46		20:30		10:30	19 59.798N	139 59.461E	4658	CTD-CMS FINISHED
St47	3-Sep	0:40		14:40	18 59.656N	140 00.185E	4242	CTD-CMS STARTED
St47		0:54		14:54	18 59.663N	140 00.443E	4251	NORPAC NET STARTED
St47		1:07		15:07	18 59.641N	140 00.611E	4281	NORPAC NET FINISHED
St47		1:31		15:31	18 59.714N	140 01.066E	4487	CTD-CMS FINISHED
St47		1:48		15:48	18 59.629N	140 01.389E	4461	ORI NET STARTED
St47		2:48		16:48	18 58.292N	140 03.356E	4497	ORI NET FINISHED
St48		5:01		19:01	18 29.846N	140 00.128E	4760	ORI NET STARTED
St48		5:21		19:21	18 29.244N	140 00.883E	4686	NEUSTON NET STARTED
St48		5:35		19:35	18 28.894N	140 01.349E	4641	NEUSTON NET FINISHED
St48		6:09		20:09	18 28.110N	140 02.407E	4638	ORI NET FINISHED
		6:27		20:27	18 26.006N	140 01.961E	4236	SUNRISE
St49		8:17		22:17	17 59.950N	140 00.007E	5202	CTD-CMS STARTED
St49		8:33		22:33	17 59.911N	140 00.131E	5194	NORPAC NET STARTED
St49		8:46		22:46	17 59.924N	140 00.251E	5187	NORPAC NET FINISHED
St49		9:01		23:01	17 59.930N	140 00.382E	5189	CTD-CMS FINISHED
St49		9:08		23:08	17 59.985N	140 00.503E	5127	ORI NET STARTED
St49		9:19		23:19	17 59.682N	140 00.565E	4742	NEUSTON NET STARTED
St49		9:37		23:37	17 59.034N	140 00.666E	4555	NEUSTON NET FINISHED
St50		10:11	3-Sep	0:11	17 58.154N	140 00.771E	4572	ORI NET FINISHED
St50		12:13		2:13	17 29.991N	139 59.954E	4878	ORI NET STARTED
St50		13:17		3:17	17 27.590N	139 59.065E	4884	ORI NET FINISHED
St51		15:23		5:23	16 59.600N	139 59.832E	4505	CTD-CMS STARTED
		15:34		5:34	16 59.550N	139 59.688E	4508	NORPAC NET STARTED
		15:46		5:46	16 59.498N	139 59.506E	4513	NORPAC NET FINISHED
St51		16:08		6:08	16 59.366N	139 59.218E	4482	CTD-CMS FINISHED
St51		16:14		6:14	16 59.306N	139 59.063E	4605	ORI NET STARTED
St51		16:23		6:23	16 59.039N	139 58.759E	4586	NEUSTON NET STARTED
St51		16:56		6:56	16 58.023N	139 57.540E	5130	NEUSTON NET FINISHED
St51		17:20		7:20	16 57.299N	139 56.667E	4949	ORI NET FINISHED
		18:53		8:53	16 35.758N	140 00.064E	4674	SUNSET
St52		19:17		9:17	16 30.584N	140 00.253E	4516	ORI NET STARTED
St52		19:26		9:26	16 30.377N	139 59.966E	4541	NEUSTON NET STARTED
St52		19:58		9:58	16 29.595N	139 59.028E	4655	NEUSTON NET FINISHED
St52		20:13		10:13	16 29.292N	139 58.662E	4826	ORI NET FINISHED
St53		22:22		12:22	16 00.357N	139 59.926E	5114	CTD-CMS STARTED
St53		22:30		12:30	16 00.281N	139 59.896E	5144	NORPAC NET STARTED
St53		22:42		12:42	16 00.234N	139 59.930E	5146	NORPAC NET FINISHED
St53		23:00		13:00	16 00.192N	139 59.992E	5144	CTD-CMS FINISHED
St53		23:06		13:06	16 00.183N	140 00.014E	5146	ORI NET STARTED
St53		23:18		13:18	15 59.898N	139 59.841E	5120	NEUSTON NET STARTED
St53		23:53		13:53	15 58.944N	139 59.354E	5134	NEUSTON NET FINISHED
St53	4-Sep	0:09		14:09	15 58.522N	139 59.158E	5152	ORI NET FINISHED
St54		2:18		16:18	15 29.859N	140 00.014E	5047	ORI NET STARTED
St54		3:16		17:16	15 28.390N	139 58.980E	5053	ORI NET FINISHED
St55		5:27		19:27	14 59.858N	140 00.048E	4928	CTD-CMS STARTED
St55		5:40		19:40	14 59.873N	139 59.890E	4940	NORPAC NET STARTED
St55		5:53		19:53	14 59.904N	139 59.886E	4942	NORPAC NET FINISHED
St55		6:07		20:07	14 59.936N	139 59.835E	4947	CTD-CMS FINISHED
St55		6:12		20:12	14 59.971N	139 59.887E	4946	ORI NET STARTED
St55		6:20		20:20	14 59.783N	139 59.794E	4936	NEUSTON NET STARTED
		6:28		20:28	14 59.486N	139 59.659E	4918	SUNRISE
St55		6:53		20:53	14 58.796N	139 59.350E	4883	NEUSTON NET FINISHED
St55		7:12		21:12	14 58.346N	139 59.113E	4840	ORI NET FINISHED
St56		9:19		23:19	14 30.427N	139 59.888E	4916	ORI NET STARTED
St56		9:28		23:28	14 30.280N	139 59.739E	4917	NEUSTON NET STARTED
St56		10:04	4-Sep	0:04	14 29.368N	139 59.058E	4911	NEUSTON NET FINISHED
St57		10:20		0:20	14 29.078N	139 58.824E	4886	ORI NET FINISHED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
St57		12:31		2:31	13 59.939N	139 59.850E	5026	CTD-CMS STARTED
St57		12:41		2:41	14 00.059N	139 59.741E	5025	NORPAC NET STARTED
St57		12:55		2:55	14 00.183N	139 59.558E	5026	NORPAC NET FINISHED
St57		13:15		3:15	14 00.308N	139 59.391E	5026	CTD-CMS FINISHED
St57		13:38		3:38	14 00.517N	139 59.288E	5027	ORI NET STARTED
St57		14:39		4:39	13 58.911N	139 58.086E	5024	ORI NET FINISHED
St58		16:44		6:44	13 30.033N	140 00.030E	4909	ORI NET STARTED
St58		16:54		6:54	13 29.699N	139 59.888E	4807	NEUSTON NET STARTED
St58		17:33		7:33	13 28.188N	139 59.285E	4906	NEUSTON NET FINISHED
St58		17:55		7:55	13 27.431N	139 58.956E	4908	ORI NET FINISHED
		18:51		8:51	13 15.234N	139 59.697E	4697	SUNSET
St59		19:54		9:54	12 59.964N	139 59.995E	4863	CTD-CMS STARTED
St59		20:02		10:02	12 59.894N	140 00.006E	4860	NORPAC NET STARTED
St59		20:15		10:15	12 59.924N	140 00.007E	4862	NORPAC NET FINISHED
St59		20:35		10:35	12 59.862N	140 00.088E	4858	CTD-CMS FINISHED
St59		20:42		10:42	12 59.987N	140 00.073E	4862	ORI NET STARTED
St59		20:51		10:51	12 59.903N	140 00.071E	4860	NEUSTON NET STARTED
St59		21:27		11:27	12 58.453N	140 00.012E	4580	NEUSTON NET FINISHED
St59		21:51		11:51	12 57.734N	139 59.946E	4339	ORI NET FINISHED
	5-Sep	6:20		20:20	13 57.726N	142 00.937E	4192	SUNRISE
St60		8:46		22:46	14 15.019N	142 36.626E	3008	CTD-CMS STARTED
St60		9:29		23:29	14 15.545N	142 36.747E	2952	CTD-CMS FINISHED
		10:45	5-Sep	0:45	14 14.285N	142 52.528E	0	ABIS STARTED
		12:08		2:08	14 13.935N	142 52.185E	343	ABIS FINISHED
		13:09		3:09	14 12.948N	142 53.166E	134	HOOKING NET STARTED
		15:14		5:14	14 12.877N	142 53.246E	240	HOOKING NET FINISHED
St61		16:48		6:48	14 30.179N	142 52.003E	2368	CTD-CMS STARTED
St61		17:28		7:28	14 30.338N	142 52.014E	2355	CTD-CMS FINISHED
		18:38		8:38	14 15.861N	142 51.750E	1527	SUNSET
St62		19:47		9:47	14 00.042N	142 52.009E	3253	CTD-CMS STARTED
St62		20:25		10:25	14 00.311N	142 52.066E	3201	CTD-CMS FINISHED
St63		22:01		12:01	14 15.078N	143 07.061E	3943	CTD-CMS STARTED
St63		22:50		12:50	14 15.276N	143 07.195E	3935	CTD-CMS FINISHED
St64	6-Sep	1:01		15:01	14 15.164N	142 36.593E	2998	ORI NET STARTED
St64		2:05		16:05	14 17.514N	142 37.226E	2814	ORI NET FINISHED
St65		3:40		17:40	14 30.274N	142 52.017E	2359	ORI NET STARTED
St65		4:42		18:42	14 28.784N	142 51.782E	2186	ORI NET FINISHED
		5:59		19:59	14 14.282N	142 52.250E	0	ABIS STARTED
		6:16		20:16	14 12.919N	142 53.299E	232	SUNRISE
		7:58		21:58	14 14.458N	142 52.619E	386	ABIS FINISHED
		8:51		22:51	14 14.436N	142 52.702E	357	HOOKING NET STARTED
		11:28	6-Sep	1:28	14 14.495N	142 52.659E	422	HOOKING NET FINISHED
St66		13:56		3:56	13 51.180N	143 00.031E	2550	ORI NET STARTED
St66		15:04		5:04	13 53.473N	143 01.473E	2476	ORI NET FINISHED
St67		16:09		6:09	14 05.895N	142 59.941E	3794	ORI NET STARTED
St67		17:20		7:20	14 08.761N	142 58.826E	3297	ORI NET FINISHED
St68		18:19		8:19	14 20.736N	143 00.182E	1890	ORI NET STARTED
		18:37		8:37	14 21.439N	142 59.967E	1843	SUNSET
St68		19:20		9:20	14 23.062N	142 59.579E	1879	ORI NET FINISHED
St69		20:26		10:26	14 35.954N	143 00.090E	2689	ORI NET STARTED
St69		21:26		11:26	14 37.717N	142 59.331E	2807	ORI NET FINISHED
St70		22:37		12:37	14 35.987N	142 45.032E	3360	ORI NET STARTED
St70		23:39		13:39	14 34.596N	142 44.141E	3366	ORI NET FINISHED
St71	7-Sep	0:50		14:50	14 20.878N	142 44.907E	2681	ORI NET STARTED
St71		1:53		15:53	14 20.964N	142 42.583E	3073	ORI NET FINISHED
St72		3:18		17:18	14 05.742N	142 44.983E	2176	ORI NET STARTED
St72		4:24		18:24	14 05.083N	142 43.126E	2369	ORI NET FINISHED
St73		5:36		19:36	13 51.151N	142 45.166E	2224	ORI NET STARTED
		6:18		20:18	13 50.872N	142 43.759E	1864	SUNRISE
St73		6:37		20:37	13 50.812N	142 43.202E	1870	ORI NET FINISHED
St74		7:40		21:40	13 50.859N	142 30.026E	2564	ORI NET STARTED
St74		8:48		22:48	13 53.660N	142 29.299E	2658	ORI NET FINISHED
St75		9:48		23:48	14 05.877N	142 30.095E	3090	ORI NET STARTED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
St75		10:56	7-Sep	0:56	14 08.065N	142 29.312E	3126	ORI NET FINISHED
St76		12:04		2:04	14 21.097N	142 29.971E	3657	ORI NET STARTED
St76		13:06		3:06	14 22.814N	142 28.162E	3742	ORI NET FINISHED
St77		14:15		4:15	14 35.773N	142 29.989E	2646	ORI NET STARTED
St77		15:14		5:14	14 34.401N	142 31.220E	2454	ORI NET FINISHED
		18:36		8:36	13 53.183N	142 58.484E	3359	SUNSET
St78		18:51		8:51	13 51.050N	143 00.042E	2505	ORI NET STARTED
St78		19:52		9:52	13 53.058N	143 01.165E	2370	ORI NET FINISHED
St79		20:58		10:58	14 05.876N	142 59.925E	3794	ORI NET STARTED
St79		22:07		12:07	14 07.740N	142 58.192E	3090	ORI NET FINISHED
St80		23:16		13:16	14 20.798N	142 59.941E	1856	ORI NET STARTED
St80	8-Sep	0:18		14:18	14 22.495N	143 01.075E	1875	ORI NET FINISHED
St81		1:27		15:27	14 35.454N	143 00.409E	2625	ORI NET STARTED
St81		2:28		16:28	14 35.163N	142 58.331E	2685	ORI NET FINISHED
St82		3:37		17:37	14 36.409N	142 45.330E	3368	ORI NET STARTED
St82		4:39		18:39	14 36.149N	142 43.184E	3396	ORI NET FINISHED
St83		5:56		19:56	14 21.496N	142 45.208E	2628	ORI NET STARTED
		6:17		20:17	14 21.151N	142 44.535E	2718	SUNRISE
St83		6:57		20:57	14 20.974N	142 43.428E	3032	ORI NET FINISHED
St84		8:16		22:16	14 06.436N	142 44.899E	2078	ORI NET STARTED
St84		9:15		23:15	14 06.202N	142 43.221E	2264	ORI NET FINISHED
St85		10:35	8-Sep	0:35	13 51.234N	142 44.890E	1973	ORI NET STARTED
St85		11:33		1:33	13 51.223N	142 43.050E	1922	ORI NET FINISHED
St86		12:37		2:37	13 51.134N	142 30.291E	2577	ORI NET STARTED
St86		13:42		3:42	13 53.658N	142 28.921E	2629	ORI NET FINISHED
St87		14:43		4:43	14 06.165N	142 29.918E	3119	ORI NET STARTED
St87		15:44		5:44	14 07.604N	142 28.038E	3046	ORI NET FINISHED
St88		16:45		6:45	14 21.047N	142 29.995E	3656	ORI NET STARTED
St88		17:50		7:50	14 23.524N	142 31.290E	3651	ORI NET FINISHED
		18:37		8:37	14 34.275N	142 30.164E	2807	SUNSET
St89		18:52		8:52	14 35.994N	142 29.915E	2727	CTD-CMS STARTED
St89		19:24		9:24	14 36.391N	142 29.624E	2857	CTD-CMS FINISHED
St89		19:27		9:27	14 36.490N	142 29.679E	2838	ORI NET STARTED
St89		20:33		10:33	14 37.490N	142 31.584E	2491	ORI NET FINISHED
St90	9-Sep	0:23		14:23	13 51.085N	143 00.055E	2513	ORI NET STARTED
St90		1:28		15:28	13 53.291N	142 59.942E	2867	ORI NET FINISHED
St91		2:34		16:34	14 06.030N	142 59.993E	3789	ORI NET STARTED
St91		3:37		17:37	14 08.209N	142 59.697E	3707	ORI NET FINISHED
St92		4:43		18:43	14 20.917N	143 00.078E	1881	ORI NET STARTED
St92		5:44		19:44	14 23.100N	142 59.676E	1883	ORI NET FINISHED
		6:16		20:16	14 28.695N	143 00.028E	2117	SUNRISE
St93		6:47		20:47	14 35.809N	142 59.919E	2676	ORI NET STARTED
St93		7:47		21:47	14 36.729N	142 57.621E	2712	ORI NET FINISHED
St94		8:49		22:49	14 36.062N	142 45.214E	3348	ORI NET STARTED
St94		9:48		23:48	14 35.457N	142 43.698E	3373	ORI NET FINISHED
St95		11:02	9-Sep	1:02	14 21.356N	142 44.970E	2675	ORI NET STARTED
St95		12:01		2:01	14 20.576N	142 43.266E	3010	ORI NET FINISHED
St96		13:16		3:16	14 06.141N	142 45.027E	2016	ORI NET STARTED
St96		14:16		4:16	14 04.272N	142 45.161E	2124	ORI NET FINISHED
St97		15:24		5:24	13 51.350N	142 44.940E	2029	ORI NET STARTED
St97		16:31		6:31	13 51.827N	142 42.585E	2032	ORI NET FINISHED
St98		17:34		7:34	13 51.037N	142 30.036E	2593	ORI NET STARTED
St98		17:41		7:41	13 51.282N	142 30.117E	2586	NEUSTON NET STARTED
St98		18:07		8:07	13 52.354N	142 30.565E	2523	NEUSTON NET FINISHED
		18:36		8:36	13 53.495N	142 31.051E	2690	SUNSET
St98		18:38		8:38	13 53.566N	142 31.080E	2703	ORI NET FINISHED
St99		19:35		9:35	14 06.044N	142 29.925E	3096	ORI NET STARTED
St99		20:41		10:41	14 08.882N	142 30.542E	3175	ORI NET FINISHED
St100		21:39		11:39	14 20.895N	142 29.976E	3653	ORI NET STARTED
St100		22:46		12:46	14 23.047N	142 31.210E	3643	ORI NET FINISHED
St101		23:49		13:49	14 36.061N	142 29.985E	2548	ORI NET STARTED
St101	10-Sep	0:49		14:49	14 37.210N	142 31.639E	2319	ORI NET FINISHED
St102		4:35		18:35	13 50.997N	143 00.000E	2502	ORI NET STARTED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
St102		4:41		18:41	13 51.189N	142 59.952E	2572	NEUSTON NET STARTED
St102		5:06		19:06	13 52.119N	142 59.756E	2989	NEUSTON NET FINISHED
St102		5:35		19:35	13 53.004N	142 59.529E	2949	ORI NET FINISHED
		6:16		20:16	14 01.029N	142 59.923E	4324	SUNRISE
St103		6:37		20:37	14 05.705N	143 00.038E	3771	ORI NET STARTED
St103		7:38		21:38	14 07.693N	142 59.527E	3736	ORI NET FINISHED
St104		8:42		22:42	14 20.873N	142 59.946E	1872	ORI NET STARTED
St104		9:41		23:41	14 22.807N	142 59.801E	1857	ORI NET FINISHED
St105		10:47	10-Sep	0:47	14 35.873N	142 59.925E	2683	ORI NET STARTED
St105		10:55		0:55	14 35.930N	142 59.733E	2686	NEUSTON NET STARTED
St105		11:18		1:18	14 36.070N	142 58.846E	2727	NEUSTON NET FINISHED
St105		11:47		1:47	14 36.190N	142 57.932E	2686	ORI NET FINISHED
St106		12:52		2:52	14 36.101N	142 45.167E	3350	ORI NET STARTED
St106		13:53		3:53	14 35.126N	142 43.468E	3364	ORI NET FINISHED
St107		15:03		5:03	14 20.989N	142 45.056E	2639	ORI NET STARTED
St107		16:07		6:07	14 19.119N	142 45.620E	2739	ORI NET FINISHED
St108		17:11		7:11	14 06.135N	142 44.989E	2018	ORI NET STARTED
St108		18:10		8:10	14 04.453N	142 45.509E	2052	ORI NET FINISHED
		18:35		8:35	14 00.665N	142 45.272E	1618	SUNSET
St109		19:15		9:15	13 51.263N	142 44.872E	1967	ORI NET STARTED
St109		20:15		10:15	13 51.147N	142 42.752E	1954	ORI NET FINISHED
St110		21:18		11:18	13 51.083N	142 30.166E	2587	ORI NET STARTED
St110		22:21		12:21	13 52.469N	142 28.451E	2661	ORI NET FINISHED
St111		23:30		13:30	14 06.032N	142 29.976E	3118	ORI NET STARTED
St111	11-Sep	0:31		14:31	14 07.566N	142 28.134E	3046	ORI NET FINISHED
St112		1:38		15:38	14 20.873N	142 29.988E	3653	ORI NET STARTED
St112		2:35		16:35	14 21.966N	142 31.667E	3586	ORI NET FINISHED
St113		3:46		17:46	14 36.085N	142 29.912E	2640	ORI NET STARTED
St113		3:53		17:53	14 36.024N	142 30.114E	2403	NEUSTON NET STARTED
St113		4:18		18:18	14 35.801N	142 30.841E	2047	NEUSTON NET FINISHED
St113		4:44		18:44	14 35.638N	142 31.439E	1852	ORI NET FINISHED
		6:17		20:17	14 17.642N	142 42.495E	1827	SUNRISE
St114		8:18		22:18	13 51.139N	142 59.812E	2648	ORI NET STARTED
St114		8:26		22:26	13 51.113N	142 59.961E	2587	NEUSTON NET STARTED
St114		8:51		22:51	13 51.156N	143 00.801E	2720	NEUSTON NET FINISHED
St114		9:22		23:22	13 51.082N	143 01.453E	3066	ORI NET FINISHED
St115		10:35	11-Sep	0:35	14 05.642N	142 59.996E	3767	ORI NET STARTED
St115		11:36		1:36	14 06.303N	143 01.635E	3881	ORI NET FINISHED
St116		12:49		2:49	14 20.960N	142 59.976E	1870	ORI NET STARTED
St116		13:53		3:53	14 21.720N	143 01.584E	1955	ORI NET FINISHED
St117		15:07		5:07	14 35.747N	142 59.918E	2664	ORI NET STARTED
St117		15:14		5:14	14 35.847N	142 59.642E	2684	NEUSTON NET STARTED
St117		15:38		5:38	14 36.161N	142 58.737E	2728	NEUSTON NET FINISHED
St117		16:12		6:12	14 36.400N	142 57.775E	2692	ORI NET FINISHED
St118		17:13		7:13	14 35.738N	142 44.970E	3366	ORI NET STARTED
St118		18:14		8:14	14 33.635N	142 44.952E	3310	ORI NET FINISHED
		18:35		8:35	14 30.598N	142 45.008E	3048	SUNSET
St119		19:14		9:14	14 21.323N	142 44.968E	2672	ORI NET STARTED
St119		20:11		10:11	14 19.546N	142 45.107E	2832	ORI NET FINISHED
St120		21:17		11:17	14 06.234N	142 44.995E	2005	ORI NET STARTED
St120		22:18		12:18	14 04.399N	142 45.069E	2138	ORI NET FINISHED
St121		23:23		13:23	13 51.274N	142 44.945E	1982	ORI NET STARTED
St121	12-Sep	0:21		14:21	13 50.125N	142 43.207E	1939	ORI NET FINISHED
St122		1:29		15:29	13 51.223N	142 29.992E	2592	ORI NET STARTED
St122		2:33		16:33	13 52.854N	142 31.822E	2654	ORI NET FINISHED
St123		3:42		17:42	14 05.866N	142 29.981E	3080	ORI NET STARTED
St123		4:47		18:47	14 07.604N	142 31.709E	3204	ORI NET FINISHED
St124		5:47		19:47	14 21.122N	142 29.954E	3659	ORI NET STARTED
St124		5:52		19:52	14 21.287N	142 30.057E	3660	NEUSTON NET STARTED
St124		6:17		20:17	14 22.156N	142 30.630E	3634	NEUSTON NET FINISHED
		6:18		20:18	14 22.175N	142 30.638E	3634	SUNRISE
St124		6:50		20:50	14 23.412N	142 31.286E	3644	ORI NET FINISHED
St125		7:46		21:46	14 35.896N	142 30.033E	2532	ORI NET STARTED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
St125		8:53		22:53	14 37.310N	142 27.571E	3492	ORI NET FINISHED
St126		12:11	12-Sep	2:11	15 05.778N	141 45.047E	4542	ORI NET STARTED
St126		12:18		2:18	15 05.548N	141 45.005E	4552	NEUSTON NET STARTED
St126		12:39		2:39	15 04.631N	141 44.927E	4562	NEUSTON NET FINISHED
St126		13:12		3:12	15 03.453N	141 44.831E	4584	ORI NET FINISHED
St127		14:15		4:15	14 50.997N	141 44.993E	4574	ORI NET STARTED
St127		15:16		5:16	14 48.903N	141 44.676E	4588	ORI NET FINISHED
St128		16:19		6:19	14 36.295N	141 44.951E	4594	ORI NET STARTED
St128		16:26		6:26	14 36.086N	141 44.940E	4599	NEUSTON NET STARTED
St128		16:48		6:48	14 35.296N	141 44.854E	4597	NEUSTON NET FINISHED
St128		17:18		7:18	14 34.331N	141 44.695E	4600	ORI NET FINISHED
St129		18:20		8:20	14 21.490N	141 44.909E	4554	ORI NET STARTED
		18:39		8:39	14 20.792N	141 44.785E	4558	SUNSET
St129		19:21		9:21	14 19.415N	141 44.660E	4561	ORI NET FINISHED
St130		20:23		10:23	14 06.264N	141 45.053E	4550	ORI NET STARTED
St130		21:28		11:28	14 04.113N	141 44.959E	4580	ORI NET FINISHED
St131		22:32		12:32	13 51.392N	141 45.025E	4488	ORI NET STARTED
St131		23:36		13:36	13 51.417N	141 47.315E	4464	ORI NET FINISHED
St132	13-Sep	0:40		14:40	13 51.118N	141 59.981E	4156	ORI NET STARTED
St132		1:39		15:39	13 51.111N	142 02.106E	4072	ORI NET FINISHED
St133		2:53		16:53	14 06.240N	142 00.031E	4366	ORI NET STARTED
St133		3:56		17:56	14 06.355N	142 02.355E	4350	ORI NET FINISHED
St134		5:06		19:06	14 21.221N	142 00.037E	4312	ORI NET STARTED
St134		5:12		19:12	14 21.455N	141 59.874E	4326	NEUSTON NET STARTED
St134		5:37		19:37	14 22.287N	141 59.232E	4365	NEUSTON NET FINISHED
St134		6:07		20:07	14 23.200N	141 58.397E	4344	ORI NET FINISHED
		6:20		20:20	14 24.555N	141 58.401E	4340	SUNRISE
St135		7:07		21:07	14 35.997N	142 00.002E	4346	ORI NET STARTED
St135		8:08		22:08	14 38.106N	141 58.748E	4341	ORI NET FINISHED
St136		9:11		23:11	14 50.825N	141 59.911E	4484	ORI NET STARTED
St136		10:15	13-Sep	0:15	14 51.231N	141 57.664E	4496	ORI NET FINISHED
St137		11:29		1:29	15 05.912N	142 00.072E	4487	ORI NET STARTED
St137		11:36		1:36	15 05.856N	142 00.076E	4486	NEUSTON NET STARTED
St137		11:59		1:59	15 05.232N	141 59.558E	4491	NEUSTON NET FINISHED
St137		12:28		2:28	15 04.605N	141 58.724E	4516	ORI NET FINISHED
St138		13:53		3:53	15 05.993N	142 14.905E	4400	ORI NET STARTED
St138		14:57		4:57	15 04.438N	142 13.616E	4378	ORI NET FINISHED
St139		16:07		6:07	14 51.249N	142 15.120E	4332	ORI NET STARTED
St139		16:11		6:11	14 51.180N	142 15.107E	4334	NEUSTON NET STARTED
St139		16:37		6:37	14 50.388N	142 15.063E	4382	NEUSTON NET FINISHED
St139		17:06		7:06	14 49.762N	142 14.930E	4403	ORI NET FINISHED
St140		18:12		8:12	14 36.494N	142 14.900E	4132	ORI NET STARTED
		18:35		8:35	14 35.803N	142 14.825E	4131	SUNSET
St140		19:13		9:13	14 35.165N	142 14.702E	4089	ORI NET FINISHED
St141		20:26		10:26	14 21.392N	142 15.056E	4022	ORI NET STARTED
St141		21:28		11:28	14 20.823N	142 13.350E	4062	ORI NET FINISHED
St142		22:39		12:39	14 06.413N	142 15.064E	3870	ORI NET STARTED
St142		23:42		13:42	14 04.901N	142 15.985E	3554	ORI NET FINISHED
St143	14-Sep	0:58		14:58	13 51.059N	142 14.949E	3490	ORI NET STARTED
St143		1:58		15:58	13 50.450N	142 16.777E	3235	ORI NET FINISHED
St144		3:08		17:08	13 50.973N	142 30.031E	2583	ORI NET STARTED
St144		4:13		18:13	13 50.318N	142 32.056E	2356	ORI NET FINISHED
St145		5:27		19:27	14 06.017N	142 30.162E	3110	ORI NET STARTED
St145		5:32		19:32	14 06.152N	142 30.091E	3116	NEUSTON NET STARTED
St145		5:57		19:57	14 06.951N	142 29.522E	3124	NEUSTON NET FINISHED
		6:20		20:20	14 07.613N	142 29.067E	2990	SUNRISE
St145		6:27		20:27	14 07.765N	142 28.982E	3160	ORI NET FINISHED
St146		7:31		21:31	14 21.040N	142 29.965E	3656	ORI NET STARTED
St146		8:29		22:29	14 22.868N	142 29.809E	3690	ORI NET FINISHED
St147		9:32		23:32	14 35.691N	142 29.922E	2646	ORI NET STARTED
St147		10:31	14-Sep	0:31	14 37.630N	142 29.382E	3066	ORI NET FINISHED
St148		11:36		1:36	14 50.673N	142 30.052E	4119	ORI NET STARTED
St148		12:34		2:34	14 52.833N	142 30.251E	4153	ORI NET FINISHED

Station	Local time		Universal time		Latitude	Longitude	Depth	Comment
St149		13:43		3:43	15 06.009N	142 30.100E	3979	ORI NET STARTED
St149		14:43		4:43	15 04.103N	142 31.312E	4055	ORI NET FINISHED
St151		16:06		6:06	14 51.360N	142 44.846E	3550	ORI NET STARTED
St151		17:06		7:06	14 49.214N	142 44.705E	3676	ORI NET FINISHED
St152		18:08		8:08	14 36.293N	142 44.984E	3370	ORI NET STARTED
St152		19:08		9:08	14 34.265N	142 44.224E	3360	ORI NET FINISHED
St153		20:08		10:08	14 21.232N	142 44.921E	2660	ORI NET STARTED
St153		21:16		11:16	14 18.904N	142 45.367E	2658	ORI NET FINISHED
St154		22:19		12:19	14 06.116N	142 44.964E	2024	ORI NET STARTED
St154		23:25		13:25	14 04.036N	142 45.830E	1996	ORI NET FINISHED
St155	15-Sep	0:30		14:30	13 50.976N	142 44.985E	2244	ORI NET STARTED
St155		1:29		15:29	13 49.950N	142 46.669E	3598	ORI NET FINISHED
		1:42		15:42	13 49.767N	142 46.711E	3618	FREE FALL STARTED
		3:02		17:02	13 49.385N	142 46.263E	3595	FREE FALL FINISHED