Preliminary Report
of
The Hakuho Maru Cruise
KH-09-5 Leg 5

Jan. 29, 2009 - Feb. 10, 2009

(Eel Cruise Indian Ocean II)

Atmosphere and Ocean Research Institute
The University of Tokyo
2012

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By
The Scientific Members of the Expeditions

Edited by
Shun Watanabe, Kazuki Yokouchi, Jun Aoyama,
Tsuguo Otake and Katsumi Tsukamoto

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Preface

The KH-09-5 (Leg 5) research cruise was the second expedition of the R/V Hakuho Maru that focused on the search for the spawning areas of freshwater eels (genus *Anguilla*) that live in the western side of the Indian Ocean since the historical Carlsberg Foundation's Oceanographic Expedition Around the World from 1928-1930 by the Danish scientist Johannes Schmidt. During the 2010 cruise we also aimed to understand 1) Anguilliformes leptocephalus distribution and feeding ecology, 2) distribution and migration of amphidromous Sicydiinae gobies, and 3) the biological diversity in the western Indian Ocean near the Mascarene Ridge. A total of 28 scientists from France, Madagascar, USA and Japan, and one observation scientist from Mauritius participated in this cruise. This cruise represented actual international collaboration for studies on eels and other organisms in the western Indian Ocean.

During the cruise two *Anguilla bicolor bicolor* and a total of 579 Anguilliformes leptocephali were collected by 40 tows of the IKMT. A large number of fish larvae including a few Sicydiinae gobies were also collected. CTD observations at many of the 40 stations of IKMT towing will advance the understanding of details about the distribution and migration of fish larvae as well as eel leptocephali in relation to the oceanographic structure and currents of this interesting area. The analyses of water samples taken from several depth strata at 15 stations will provide vital information for revealing the food sources of leptocephali. The two *A. bicolor bicolor* leptocephali collected during this cruise are not enough to determine the spawning area. However, all the specimens of other leptocephali and the oceanographic data will certainly give us new insights about fish biology and ecology in the Indian Ocean.

An onboard seminar was held almost every day and a total of 20 titles were presented. A variety of interesting topics on eel biology and marine ecosystems presented by French, Madagascar, Mauritius and Japanese scientists were useful for understanding the research activities of each other. Several seeds of collaborative study on eel biology between French and Japanese scientists also came out during this cruise, which are really expected to develop into fruitful research progress in the future.

Since scientists of five different nations participated in this cruise, the official language used in the meeting and the seminar was English. Communication was therefore sometimes a little difficult, but never affected the scientific routine work. There was always a general understanding among all cruise members and an enjoyable atmosphere. There was no time loss caused by bad weather during this cruise and every observation scheduled was completed without any trouble. On behalf of all scientists aboard, I would like to express our sincere thanks to the Captain, the officers and the crew members of the R/V Hakuho Maru for their support during this cruise.

09 February 2010
Chief Scientist: Tsuguo Otake

Scientists on board HAKUHO-MARU (KH-09-5 Leg 5)

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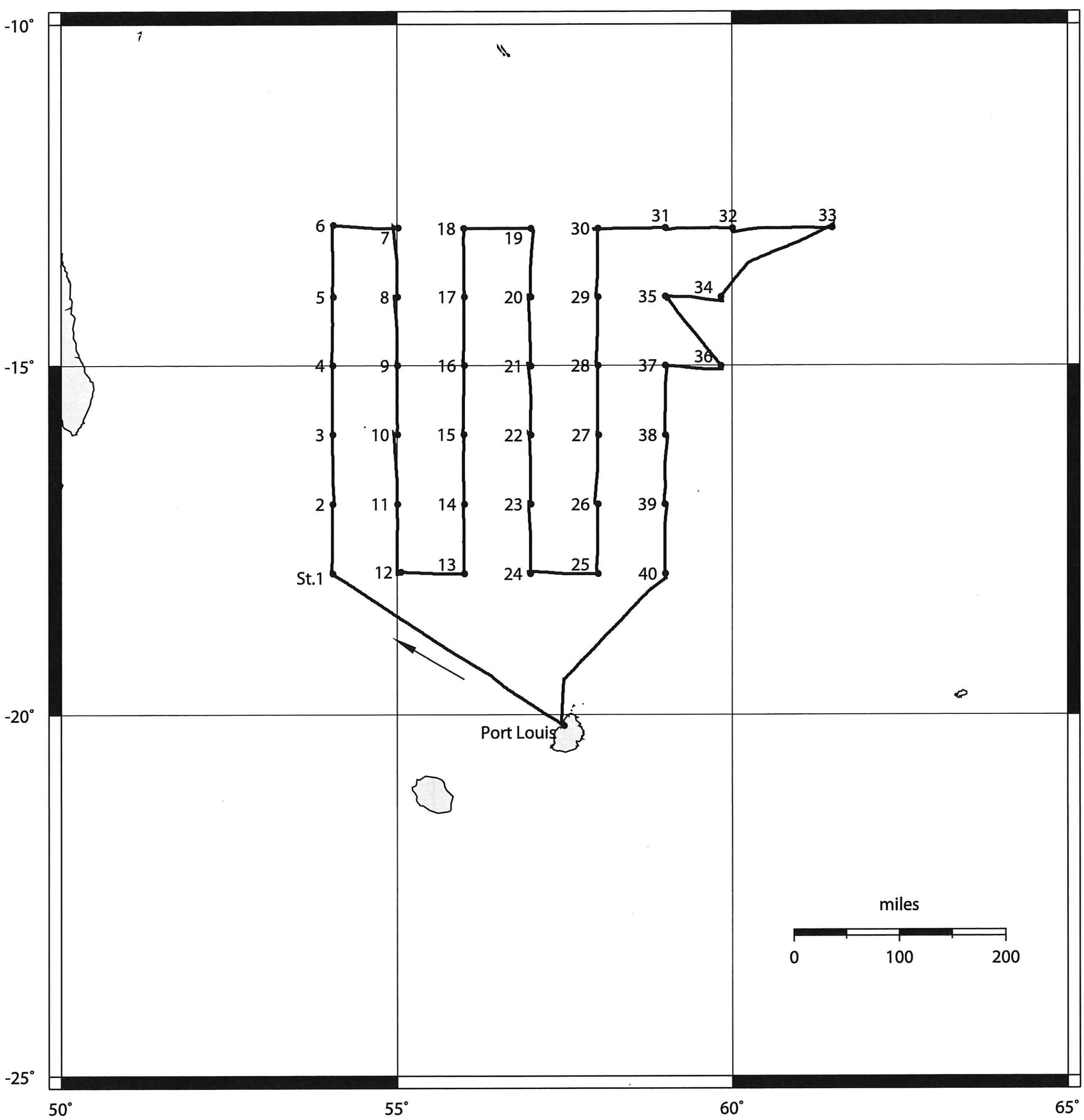
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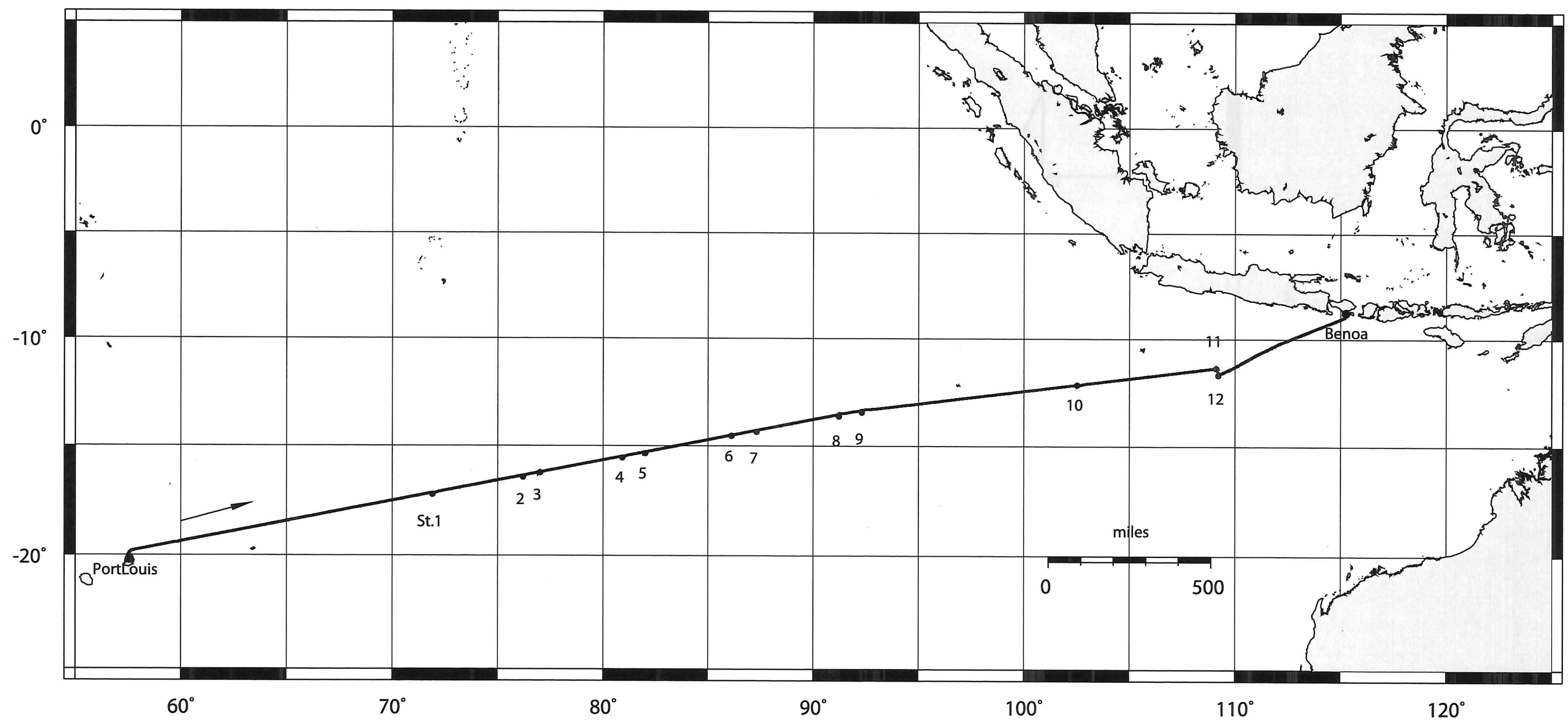

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Anguillid Leptocephali Collected during Leg 5 of KH-09-5

All Scientists onboard

Anguillid eels inhabit the continental waters on both sides of the Indian Ocean basin and they also live in the rivers and streams of Madagascar and the other smaller islands of the western Indian Ocean (Robinet et al. 2003, 2008). However, except for a general spawning region in the eastern Indian Ocean indicated by collections of various sizes of leptocephali (Jespersen 1942; Aoyama et al. 2007), where the 5 or 6 species or subspecies of Indian Ocean anguillid eels go to spawn is unknown.

Therefore the collaborative cruise between scientists from France and Japan had the objective to learn more about the spawning areas of anguillid eels in the western Indian Ocean. However, due to constraints of limited ship time being available, and concerns of potential pirate activity north of 13°S, the sampling survey of Leg 5 of KH-09-5 was concentrated in a specific area to the west of the southern Mascarene Ridge (Fig. 1). Sampling was conducted at 40 stations using an Isaacs Kidd Midwater trawl (IKMT) with an 8.7 m^2 mouth opening and 0.5 mm mesh during both day and night. Step tows that sampled 5 different layers were conducted at night (120, 90, 70, 50, 30 m for 10 min at each depth layer), and oblique tows to a depth of about 500 m were made during the day.

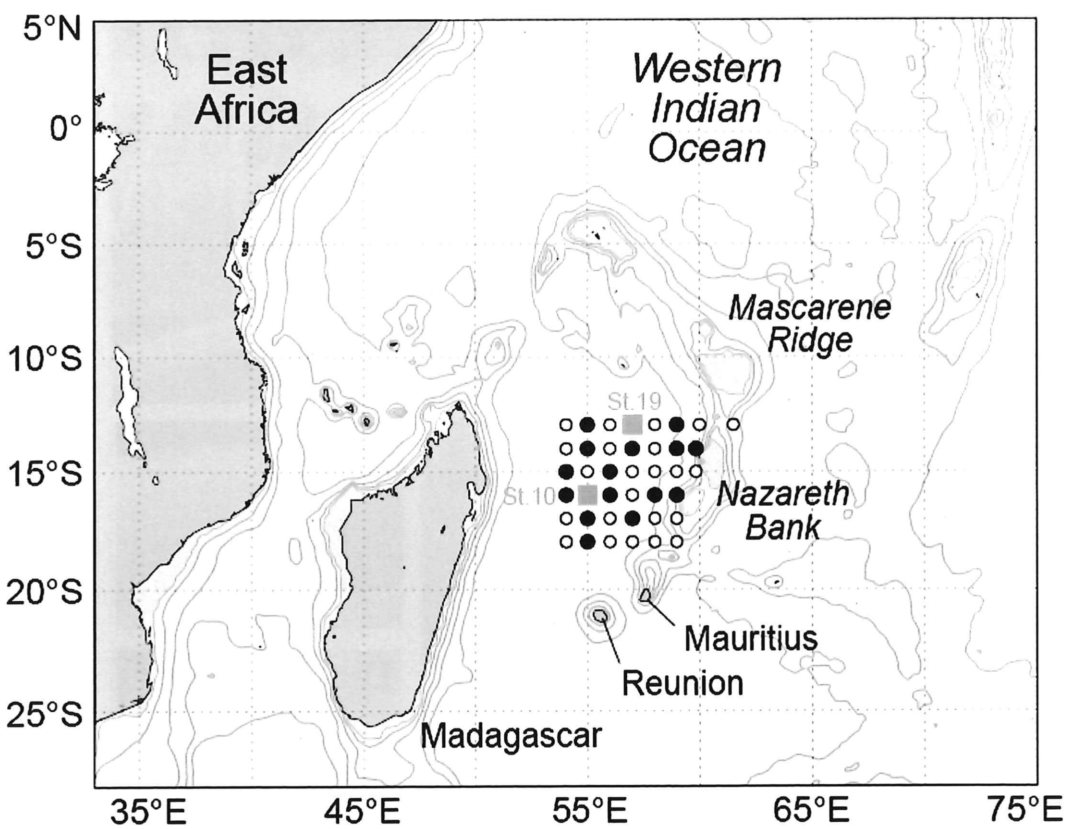

Figure 1. Map showing the stations where *Anguilla bicolor bicolor* leptocephali were collected (red squares) to the west of the Mascarene Ridge during Leg 5 of the KH-09-5 cruise. Black circles show night stations, white circles show day stations.

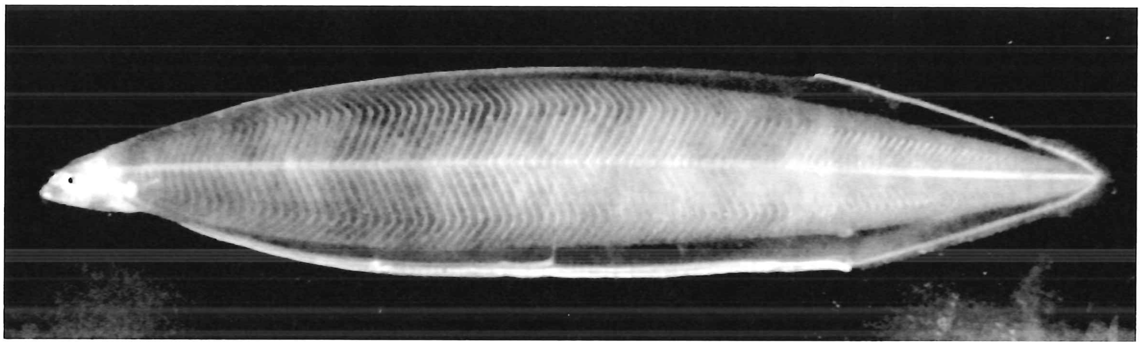

Figure 2. Photograph of a 54.1 mm TL *Anguilla bicolor bicolor* leptocephalus collected at Stn. 10 to the west of the Mascarene Ridge on 1 February 2010 during Leg 5 of the KH-09-5 cruise.

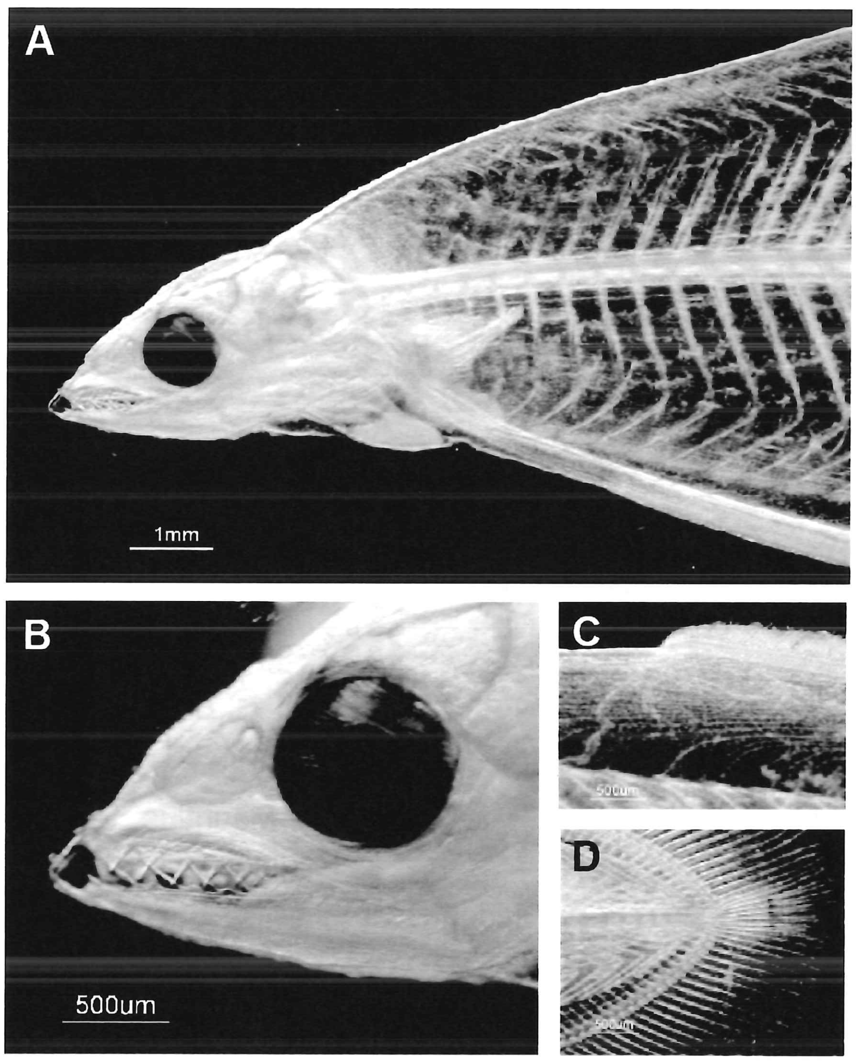

Figure 3. Photographs of a 54.1 mm TL *Anguilla bicolor bicolor* leptocephalus collected at Stn. 10 during Leg 5 of the KH-09-5 cruise showing the detailed morphology of the head region (A, B), the anterior edge of the dorsal fin (C), and the caudal fin region (D).

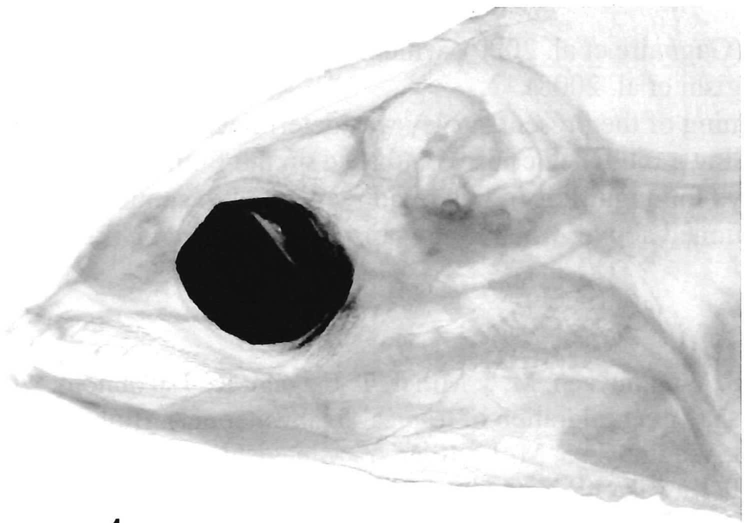

Figure 4. Head region of a 51.2 mm TL *Anguilla bicolor bicolor* leptocephalus collected at Stn. 19 on 3 February 2010 during Leg 5 of the KH-09-5 cruise showing the head features including the early gills, two otoliths, olfactory organ, and heart.

During this sampling effort, despite 579 marine eel leptocephali being collected (see leptocephali report), only 2 anguillid leptocephali were collected, indicating that anguillid leptocephali were only present in low densities in this area during this particular season. The anodorsal myomere count of these larvae (ADM: number of myomeres from the start of the dorsal fin to the start of the anal fin), and the distinctive slender body shape (Fig. 2), indicated that these larvae could be identified as *Anguilla bicolor bicolor*. The first specimen was collected at Stn. 10 (Fig. 1), was 54.1 mm TL, with 109 total myomeres (TM), and had an ADM count of 5, which is well below the separating point between shortfin and longfin leptocephali of about 8 or 9 (Jespersen 1942). The second specimen caught at Stn. 19 was 51.2 mm TL, with 110 TM, and had an ADM count of about 7 or 8. Since *A. bicolor bicolor* is the only shortfin species in this region, these specimens could be identified morphologically. This will be confirmed later using molecular genetic techniques (*e.g.* Aoyama et al. 2003, 2007; Kuroki et al. 2006, 2007, 2009; Gagnaire et al. 2007).

The low density and large size of the anguillid leptocephali during this survey indicate that this time of year is at least several months after much spawning activity had taken place near the sampling area. Anguillid eels of several species including *A. bicolor bicolor*, *A. mossambica*, and *A. marmorata* are known to recruit to the various islands of the region including Mauritius, Reunion, the Seychelles, and Madagascar (Robinet et al. 2003, 2007, 2008; Réveillac et al. 2008, 2009). Therefore to recruit to some of these areas after spawning in the westward flowing South Equatorial Current (SEC), at least some of the leptocephali must likely pass through the sampling grid of Leg 5 of KH-09-5. Based on this, and the similar result obtained in 2006 during late Nov. and early Dec., the primary spawning season of anguillids in this region can be inferred to sometime within the 6 month period of about Mar. to Sept..

Analyses of the otolith microstructure of the *A. bicolor bicolor* leptocephali collected during this survey and those from the 2006 survey can determine the spawning time of the larvae. Their age can also help evaluate their possible geographic area of origin, since the SEC has the potential to transport leptocephali long distances across the Indian Ocean basin, as has been recently suggested for *A.*

marmorata (Gagnaire et al. 2009), which has a metapopulation structure within the basin (Minegishi et al. 2008).

The timing of the present survey was determined by the many factors associated with scheduling a multi-leg cruise, but based on the findings of the present study, future surveys for anguillids in this region will need to sample at a specific time of year as mentioned above, when it now appears spawning is likely to occur.

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Migration pathways of Anguilliform Leptocephali in the Southwest Indian Ocean

Raymonde LECOMTE-FINIGER, Eric FEUNTEUN, Mari KUROKI,
Michael J. MILLER, Elodie REVEILLAC,
Katsumi TSUKAMOTO, and Tsuguo OTAKE

The small size and long development time of leptocephali have made studies on their dispersal difficult. Fish larvae usually cannot be burdened with tags, and high mortality and potentially widespread dispersal make the recovery of tags problematic. Fortunately, fish carry their own internal environmental recorders in the form of otoliths used for hearing, balance, and orientation. Otoliths are composed of calcium carbonate crystals (aragonite) within a protein matrix. They are formed at birth and grow daily as new crystal layers are deposited around the existing core by the precipitation of calcium.

Because the otoliths are metabolically inert, the elemental signature embedded in them can be an indicator of the characteristic of surrounding water masses and can be considered as proxies of environmental conditions (Campana 1999). The use of stable isotopes in otoliths offers an alternative approach to infer patterns of migration because they are generally formed in or near the O-isotope equilibrium with the mean water temperature. The oxygen isotopic composition is a reliable estimator of sea water temperature while carbon isotopic data can provide information relating to metabolic processes and the source of carbon involved in calcification.

This study using otoliths from leptocephali collected during Leg 5 of the KH-09-5 cruise in the Indian Ocean will utilize both anguillid and marine eel species of leptocephali as outlined below.

I - Anguillid leptocephali

Our aim is to clarify the routes of oceanic larval migration of anguillid eels by examining the stable oxygen (and in a minor way carbon) isotopic composition of leptocephalus otoliths. Two central questions will be addressed to learn about temperature of the water masses in which anguillid leptocephali migrate:

1. At what average depth (or t°) do the larval anguillid eels of the Indian Ocean migrate?

To address this first question, we will use the left sagittal otolith to measure the Oxygen and Carbon isotope ratios in the whole otolith. The results will be compared to the isotope ratio of water masses measured at various depths and locations. Route discrimination is based on the observation that otoliths of leptocephali inhabiting different water bodies will reflect the environmental conditions to form a unique isotopic signature in relation with the environmental conditions. This signature will reflect the proportion of time that the larvae occupied the particular water mass.

2. What are the changes of water masses used by leptocephali during their migration?

Little is known about the migration pathways of anguillid eels. Available studies on *A. japonica* and on Atlantic eels suggest that there is a shift in depth preference according to age. Recently hatched leptocephali have been mainly caught at range depths from 50 to 350 m, but they shift to being present only in the upper 100 m at night as they grow and are deeper during the day (Castonguay and McCleave 1987). This diel vertical migration pattern has been described for eel leptocephali only in a few areas of the ocean (Miller 2009), and there is no information on their vertical migration patterns in the southwest Indian Ocean.

For this analysis we will use the right sagitta to obtain ablation core samples (Nano sims or Ion Probe), from the core to the edge of the otolith. This should be a collaborative work between Japanese & French teams and the place where the analysis will be conducted needs to be decided. The otoliths of anguillid leptocephali caught in 2006 and in 2010 will hopefully be analysed.

Materials and methods

For the anguillid leptocephali, the front half of the body, including the head was preserved in ethanol, and will go to Japan (M. Kuroki). The otoliths will be extracted and the left one will be sent to R. Lecomte in Perpignan. The left one will be polished to the core for age reading (M. Kuroki) and then used for microchemical analysis (T. Otake and E. Reveillac).

II – Other anguilliform leptocephalus larvae

As is true for freshwater anguillid eels, little is known about the migration pathways of other anguilliform leptocephalus larvae. The few available studies on their depth distributions describe similar patterns as for anguillid eels, with an occurrence in the upper 100 m at night and sometimes deeper during the day (Miller 2009). There is evidence for differences in depth preference according to species and season. Mesopelagic eel leptocephali in the Atlantic, such as *Serrivomer* were caught in the upper 50 m layer, while other species were mainly found at deeper depths (Castonguay and McCleave 1997). The variation of depth preference according to age is not well known though due to a lack of studies using appropriate sampling gear. It may be hypothesized that the age/depth relationship varies among taxa, especially according to different migration loops or possible feeding preferences. Indeed, different patterns may be expected between freshwater eels, coastal eels (*i.e.* Muraenidae, Ophichthidae), and mesopelagic eels (*i.e.* Nemichthyidae) that have different spawning and recruitment areas. Between species or within species, age related differences of water depth preferences may be detected using the Oxygen isotope ratio of their otoliths.

Methods and work on board

All the leptocephali were sorted and identified to the lowest possible taxonomic level using morphological and meristic analysis. A total of 579 leptocephalus larvae were caught and the most abundant families were Congridae (32.7%), Nemichthyidae (28.5%) and Serrivomeridae (20.4%) as shown in Figure 1 (see leptocephali report).

We designed a size stratified sampling plan in the three main families to test variation of depth preference according to age/size. We collected a total of 107 leptocephali including 48 Congridae, 27 Nemichthyidae, and 18 Serrivomeridae, and from 1 to 3 specimens per family were collected of six other families (Fig. 1, bottom panel).

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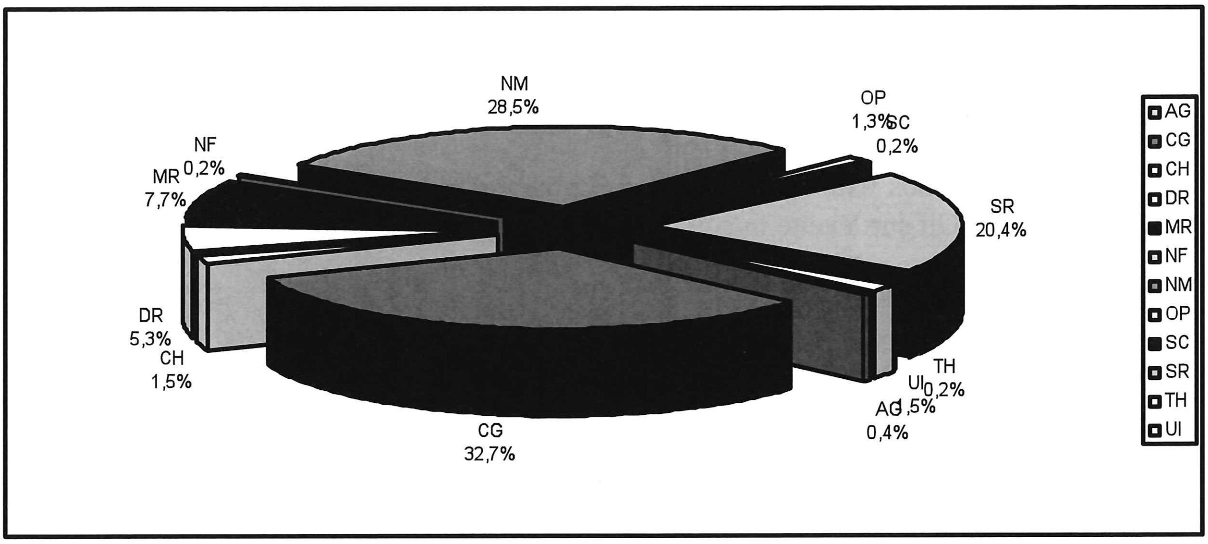

	AG	CG	CH	DR	MR	NM	OP	SC	SR	TH	UI	
N =	2	48	2	3	3	27	3	0	18	1	0	107

Figure 1. Leptocephalus assemblage composition in % of the total number of leptocephali collected (top panel). The number of specimens of each family that was preserved for analysis is shown in the lower panel. AG: Anguillidae; CG: Congridae, CH: Chlopsidae, DR: Derichthyidae, MR: Muraenidae, NM: Nemichthydae, OP: Ophichthdae, SC: Saccopharyngidae, SR: Serrivomeridae; TH: *Thallassenchelys*, UI: unidentified.

When specimens were over ca. 15 mm, heads were removed and placed in a vial that will be taken to Japan, where M. Kuroki will extract the otoliths and estimate the larval age using SEM. Then she will send both otoliths (left one whole and right one ground) to France for oxygen isotope analysis following the same procedure as that described for anguillid eels.

When specimens were smaller than ca. 15 mm they were preserved directly in ethanol vials. These specimens will be taken to Perpignan University and otoliths will be extracted. Age will tentatively be analysed without either imbedding nor grinding the otoliths. Then oxygen isotope composition will be analysed by R. Lecomte in pooled samples.

III – Water sampling.

In order to compare the relation between Oxygen isotope ratios in the water and in the otoliths, and to compare them to 2006 data, we collected 50 ml samples of water at various depths (surface and at the fluorescence max).

$\delta^{18}O$ ratio will be measured in France in collaboration with D. Blamart.

Water samples were collected at Stn. 1, 3, 6, 10, 13, 15, 18, 21, 22, 25, 27, 30, 33, 38.

Samples of gelatinous plankton were collected in order to determine their oxygen ratios:

- Hydrozoa (3 specimens)
- Siphonophora (3 specimens)
- Chaetognathe (3 specimens)
- Pteropoda (3 specimens)

The $\delta^{18}O$ isotope ratios with spectrometry in Laboratoire du Climat et des Sciences de l'Environnement-Gif sur Yvette in collaboration with D. Blamart.

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Leptocephali Collected west of the Nazareth Bank of the Mascarene Ridge during Leg 5 of KH-09-5

All Scientists onboard

The sampling survey of Leg 5 of the KH-09-5 collaborative cruise between scientists from France and Japan collected a total of 578 leptocephali of 11 anguilliform families that included at least 50 species (Table 1). An Isaacs Kidd Midwater trawl (IKMT) with an 8.7 m^2 mouth opening and 0.5 mm mesh was used to conduct an intensive grid survey at 40 stations to the west of the Nazareth Bank. This large shallow bank is the southernmost bank of the Mascarene Ridge and likely provides habitats to a variety of marine eels of the families that live at depths less than a few hundred meters, such as the Congridae, Ophichthidae, and Muraenidae.

Stations were sampled during both day and night, with step tows that fished to a maximum depth of 150 m and then horizontally at depths of about 120, 90, 70, 50, 30 m for 10 min at each depth layer at night. Oblique tows that fished to a maximum depth of about 500 m were conducted during the day. This resulted in 16 nighttime step tows that collected 469 leptocephali and 24 daytime oblique tows that collected 109 leptocephali. See the *Anguilla* report for a map of day and night stations.

Table 1. Catches of various taxa of leptocephali during the Leg 5 collaborative cruise of KH-09-5 conducted to the west of the Nazareth Bank of the Mascarene Ridge. Estimated number of species is in parentheses.

Anguillidae (1)	N	TL range	**Ophichthidae (~7)**	N	TL range
Anguilla bicolor bicolor	2	51-54	Ophichthinae	10	7-136
Congridae (15)			Myrophinae	1	80
Ariosoma sp. 2	1	202	*Neenchelys*	2	27-60
Ariosoma sp. 3	1	96	sp.	3	6-116
Ariosoma sp. 6	1	81	Juvenile/adult	1	118
Ariosoma sp. 7	39	7-156	**Synaphobranchidae (1)**		
Ariosoma sp. 8	3	11-17.0	Synaphobranchinae	1	21
Ariosoma sp.	29	9-251	**Derichthyidae (2)**		
Conger	65	8-97.0	*Derichthys*	18	9.0-35
Gnathophis	32	10-77.0	*Nessorhamphus*	1	67
Bathycongrus	3	34-130	sp.	8	9-15.0
Congrinae	2	24-88	**Nemichthyidae (1)**		
Gorgasia	7	39-51	*Nemichthys*	108	10-243
sp.	8	8-31.0	*Avocettina*	34	6-203
Chlopsidae (6)			sp.	4	8-120
Kaupichthys	1	20	**Serrivomeridae (2)**		
Robinsia caterinae	1	50	sp.	106	7-63.0
sp. 5	2	46-55	Juvenile	1	99
sp.	3	17-19	**Cyematidae (1)**		
Muraenidae (12)			*Cyema atrum*	1	18
Muraeninae	25	14-67	**Eurypharyngidae (1)**		
Uropterigyiinae	19	10-54.0	*Eurypharynx pelecanoides*	1	26
sp.	7	5-10.0	***Thallassenchelys* (1)**	1	49
			Unidentified	28	4-18.0
			Total	580	

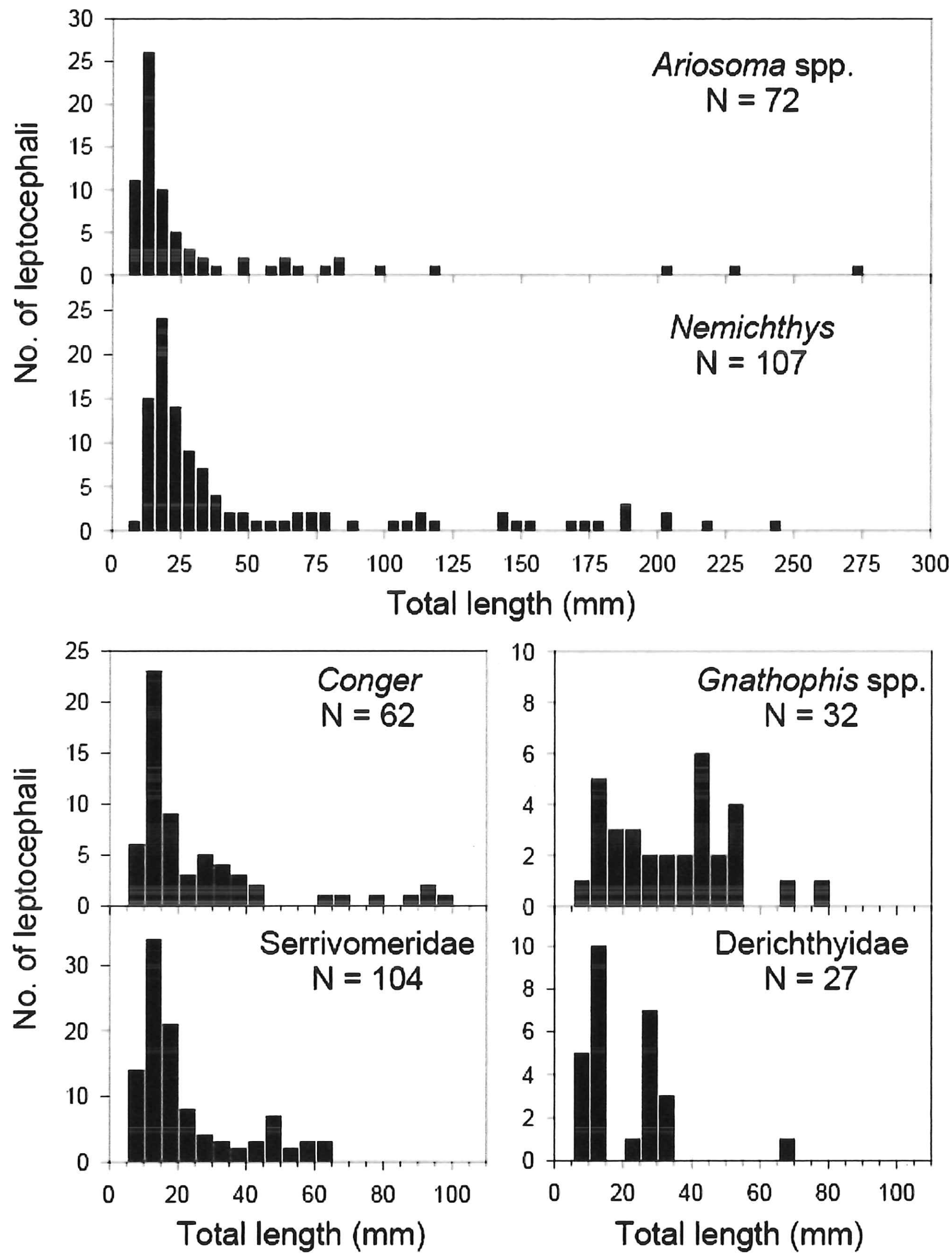


Figure 1. Length frequency distributions of several of the most abundant taxa of leptocephali collected during Leg 5 of KH-09-5 conducted to the west of the Nazareth Bank of the Mascarene Ridge.

Overall, the leptocephali of the shelf and slope marine eels of the family Congridae were the most abundant with 191 larvae being collected, and 15 species being distinguished (Table 1). This family was abundant partly due to many small *Ariosoma* and *Conger* leptocephali being collected (Figure 1). Some larger specimens of these two taxa were collected, but the dominant size of both was the 10-15 mm size class. Some *Gnathophis*, *Bathycongrus*, and *Gorgasia* leptocephali (Figure 2) were also collected, but the latter two taxa were only collected at larger sizes > 30 mm. During the cruise various specimens of the abundant taxa of congrids and other taxa were photographed with a digital imaging system that recorded the details of their external morphology (Figure 3).

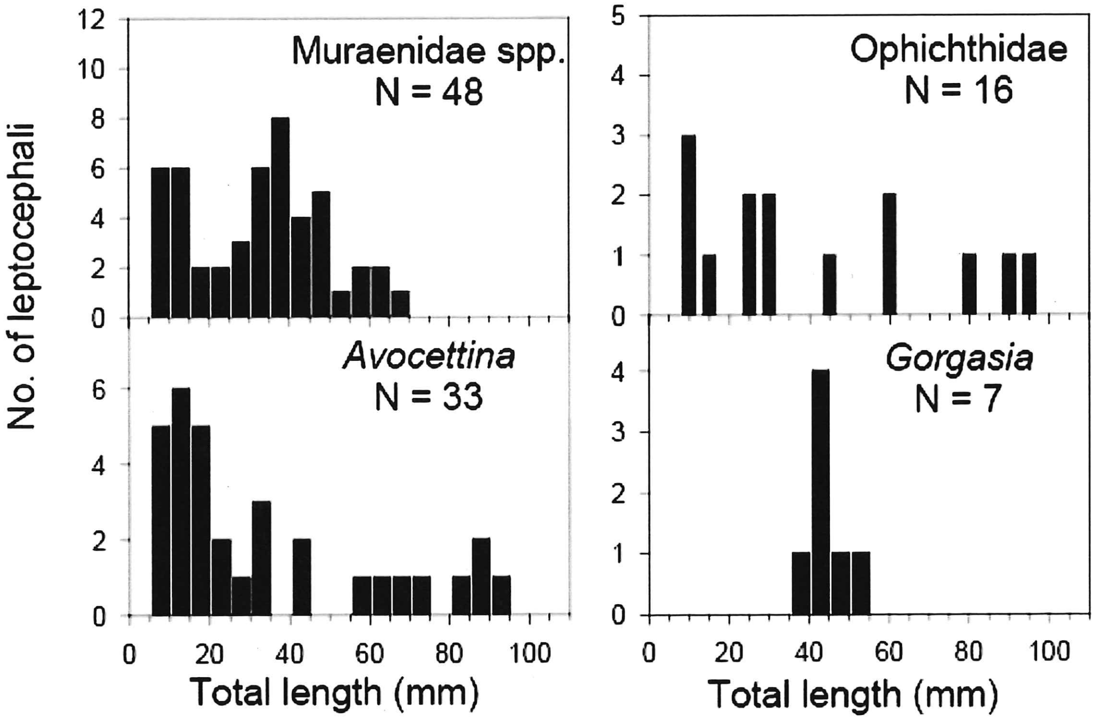


Figure 2. Length frequency distributions of taxa of leptocephali collected during Leg 5 of KH-09-5 conducted to the west of the Nazareth Bank of the Mascarene Ridge.

The leptocephali other families of shelf eels were much less abundant than the congrids, but there were 51 muraenid leptocephali collected (see Muraenidae report) at a wide size range up to almost 70 mm (Figure 1). Chlopsid leptocephali were rare (N = 7, 6 species) and only 16 ophichthid leptocephali of about 7 species were collected (Table 1). There were no Moringuidae or Nettastomatidae collected during the survey.

The next most abundant families after the congrids were the mesopelagic eel leptocephali of the Nemichthyidae and the Serrivomeridae (Table 1). They were collected at almost their complete size ranges, but both *Nemichthys* (N = 108) and the serrivomerids (N = 106) were most abundant at sizes of 10-20 mm (Figure 1). Several very large *Nemichthys* were collected at sizes of 200-250 mm long. There were also 34 *Avocettina* leptocephali (Nemichthyidae) collected at a wide range of sizes, and at least 27 leptocephali of the mesopelagic eel family Derichthyidae were also collected at various sizes (Table 1, Figure 1, 2).

This survey was conducted along the southern end of the Mascarene Ridge where the sampling survey with the IKMT in 2006 indicated that the diversity of leptocephali of shelf eels is lower. The 2010 survey showed however, that several species of congrids (*Ariosoma* and *Conger*) use these latitudes for larval development areas, as also do the leptocephali of the mesopelagic eels of the Nemichthyidae and Serrivomeridae. Future studies will analyze the assemblage structure and life history characteristics of leptocephali collected in this area in 2010 and in 2006 to learn about the early life history of marine eels that live on and around the banks of the Mascarene Ridge. These analyses can then be compared to the more than 1,100 leptocephali collected during Leg 6 of KH-09-5 at about 12 stations in the eastern 2/3 of the Indian Ocean, and the other 2006 stations that were sampled in a transect across the Indian Ocean.

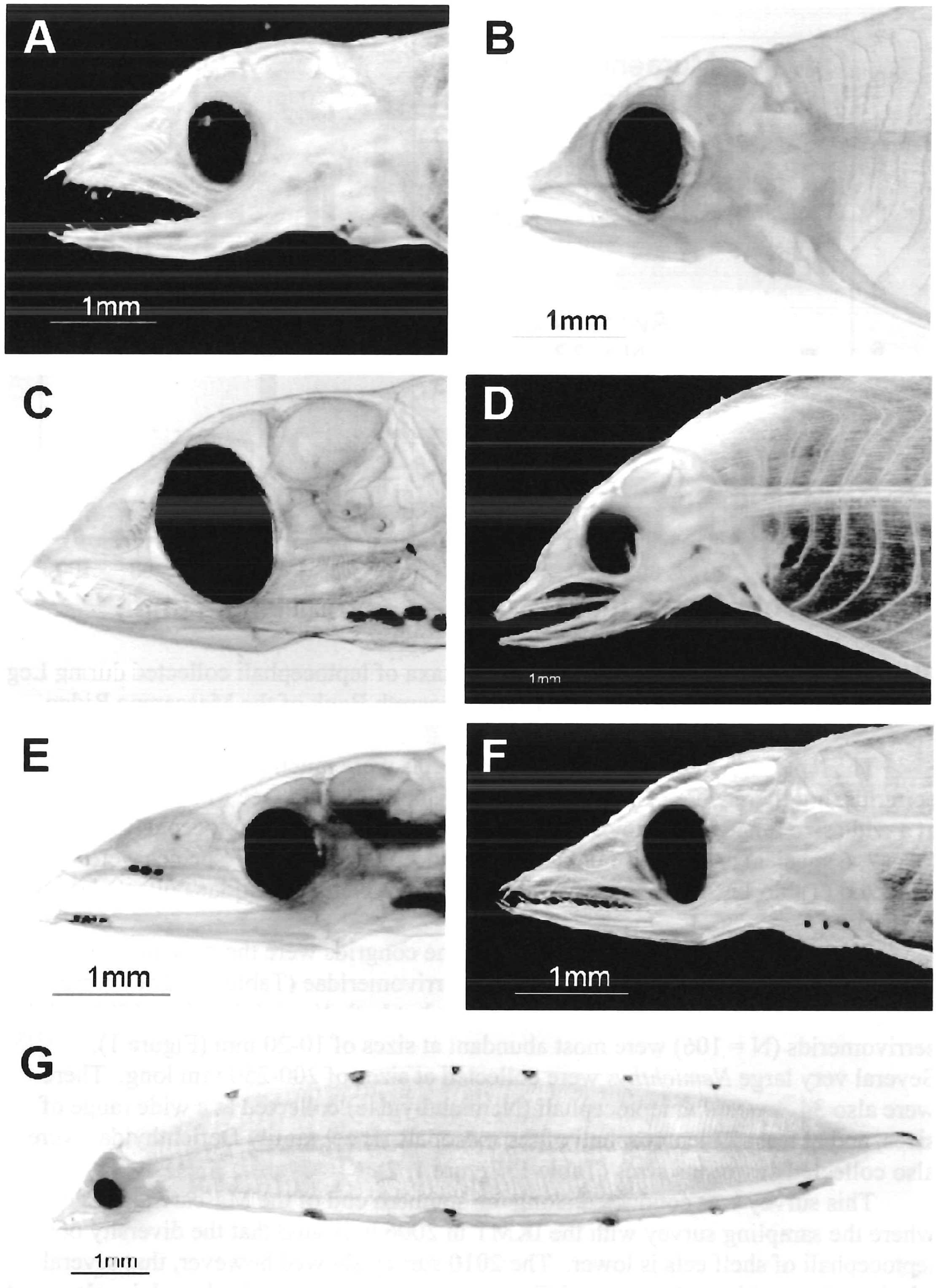


Figure 3. Photographs of various taxa of leptocephali collected during the cruise that include (A) *Gorgasia*, (B) *Derichthys*, (C) *Conger*, (D) *Ariosoma*, (E) Ophichthidae, (F) *Gnathophis* type, and (G) a small *Ariosoma* with dorsal spots that disappear in larger sized leptocephali of that species.

Taxonomical Identification of Muraenid Leptocephali Collected During the KH-09-5 Leg 5 Cruise using Morphology and DNA Barcoding.

Atsushi Tawa

Moray eels (family: Muraenidae) are one of the most diverse families of eels and more than at least 40 species have been reported in the Red Sea and western Indian Ocean (Smith 1962, Randall et al. 1995). However, only a few species or types of leptocephali have been reported (D'Ancona 1928, Nair et al. 1949,1960, Jones and Pantalu 1952). The Muraenidae is a fairly homogeneous group whose leptocephali show little fundamental variation. Genera and species groups are characterized mainly by pigmentation and fin position (Smith 1989).

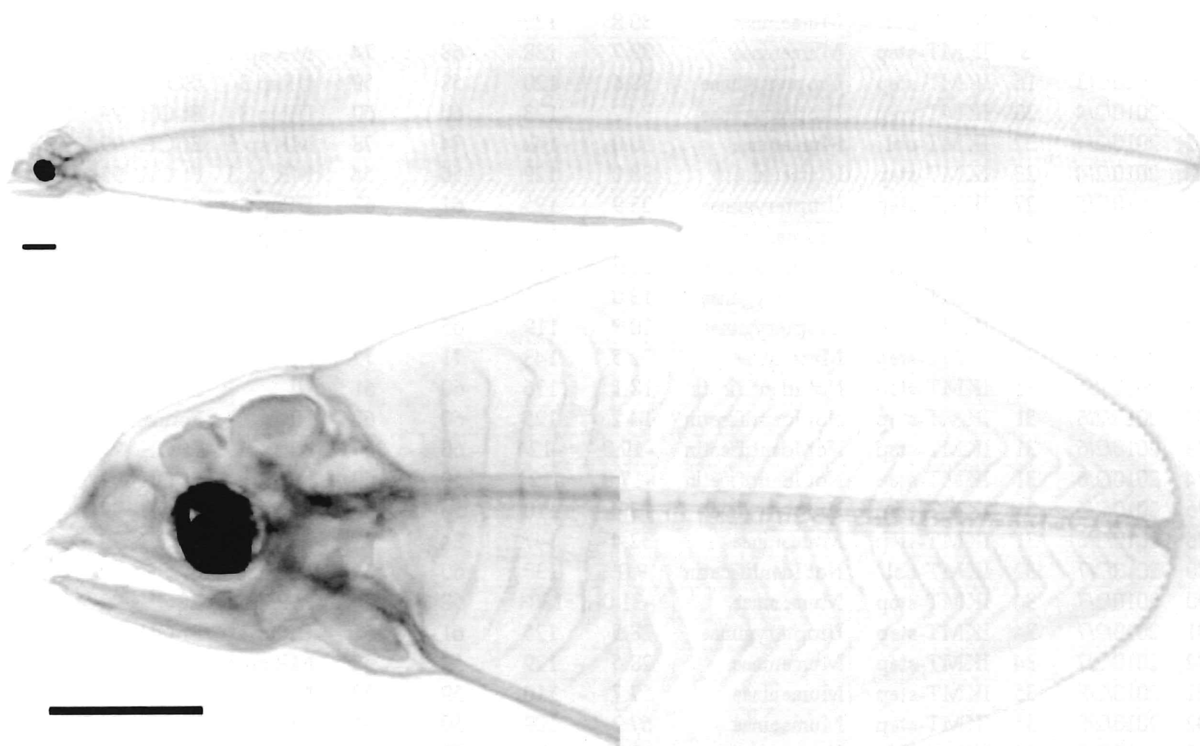


Figure 1. Lateral view of whole body, head and tail tip of UR sp. 3 type (No. 138). Bars 1 mm.

A total of 51 specimens of muraenid leptocephali were collected during the KH-09-5 Leg 5 cruise (Table 1). These specimens could be easily distinguished into 7 types of Muraeninae and 5 types of Uropterygiinae by morphology and pigmentation patterns onboard. The most abundant species was UR sp. 3 characterized by no pigment (Figure 1) and total myomere 119-128, which nearly corresponds with *Anarchias seychellensis* Smith, 1962 (Total vertebra VN: 121-132, Böhlke et al. 2001). Some VN overlap in adults, so it is very difficult to identify muraenid leptocephali to the species level morphologically, so DNA will be used.

Table 1 Sampling stations and body features of KH-09-5 Leg 5 muraenid leptocephali.

No.	Date	St.	Net	Subfamily	TL	TM	LVBV	PAM	Type	Fix.
20	2010/1/30	3	IKMT-step	Uropterygiinae	64.1	137	66	79	URsp.5	Et-OH 99.5%
26	2010/1/30	3	IKMT-step	Muraeninae	42.5	108	55	54	MR sp.1	Et-OH 99.5%
27	2010/1/30	3	IKMT-step	Muraeninae	44.2	126	57	54	MR sp.3	Et-OH 99.5%
90	2010/1/31	5	IKMT-step	Muraeninae	40.0	120	54	54	MR sp.3	Et-OH 99.5%
91	2010/1/31	7	IKMT-step	Muraeninae	46.5	124	72	81	MR sp.2	Et-OH 99.5%
92	2010/1/31	7	IKMT-step	Muraeninae	58.4	142	69	76	MR sp.6	Et-OH 99.5%
114	2010/1/31	7	IKMT-step	Muraeninae	40.2	145	83	99	MR sp.7	Et-OH 99.5%
136	2010/2/1	8	IKMT-step	Uropterygiinae	36.5	122	61	62	URsp.3	Et-OH 99.5%
138	2010/2/1	8	IKMT-step	Uropterygiinae	41.3	125	59	59	URsp.3	Et-OH 99.5%
147	2010/2/1	8	IKMT-step	Uropterygiinae	37.2	124	62	62	URsp.3	Formalin 10%
148	2010/2/1	8	IKMT-step	Uropterygiinae	39.7	120	59	59	URsp.3	Et-OH 99.5%
149	2010/2/1	8	IKMT-step	Uropterygiinae	35.8	120	59	61	URsp.3	ISO Et-OH 99.5%
150	2010/2/1	8	IKMT-step	Uropterygiinae	45.5	128	61	60	URsp.3	Et-OH 99.5%
151	2010/2/1	8	IKMT-step	Uropterygiinae	34.3	123	58	59	URsp.3	ISO Et-OH 99.5%
152	2010/2/1	8	IKMT-step	Uropterygiinae	37.5	121	59	61	URsp.3	Et-OH 99.5%
153	2010/2/1	8	IKMT-step	Muraeninae	61.1	111	57	55	MR sp.1	Et-OH 99.5%
159	2010/2/1	9	IKMT-obl	Muraeninae	30.8	130	64	69	MR sp.4	Et-OH 99.5%
160	2010/2/1	8	IKMT-step	Muraeninae	39.7	138	68	74	MR sp.5	Et-OH 99.5%
270	2010/2/3	16	IKMT-step	Uropterygiinae	38.6	120	58	59	URsp.3	ISO Et-OH 99.5%
302	2010/2/4	20	IKMT-step	Uropterygiinae	34.2	123	60	60	URsp.3	Et-OH 99.5%
312	2010/2/4	22	IKMT-obl	Muraeninae	50.0	142	74	78	MR sp.6	Et-OH 99.5%
344	2010/2/4	23	IKMT-step	Muraeninae	33.0	129	56	54	MR sp.3	Et-OH 99.5%
447	2010/2/5	27	IKMT-step	Uropterygiinae	23.9	125	61	62	URsp.3	Et-OH 99.5%
459	2010/2/6	31	IKMT-step	Uropterygiinae	15.7	132	62	57	URsp.4	Et-OH 99.5%
460	2010/2/6	31	IKMT-step	Uropterygiinae	13.9	116	64	59	URsp.2	Et-OH 99.5%
461	2010/2/6	31	IKMT-step	Uropterygiinae	13.0	121	56	57	URsp.3	Et-OH 99.5%
462	2010/2/6	31	IKMT-step	Uropterygiinae	10.9	119	65	72	URsp.3	Et-OH 99.5%
470	2010/2/6	31	IKMT-step	Muraeninae	22.5	143	71	77	MR sp.6	Et-OH 99.5%
471	2010/2/6	31	IKMT-step	Not Identificatin	18.1	126	60	61	NI	Et-OH 99.5%
472	2010/2/6	31	IKMT-step	Not Identificatin	14.2	125	60	62	NI	Formalin 10%
473	2010/2/6	31	IKMT-step	Not Identificatin	~19.0	~124	60	57	NI	Et-OH 99.5%
474	2010/2/6	31	IKMT-step	Not Identificatin	~17.8	~122	59	60	NI	Et-OH 99.5%
475	2010/2/6	31	IKMT-step	Uropterygiinae	13.4	110	56	59	URsp.1	Et-OH 99.5%
476	2010/2/6	31	IKMT-step	Muraeninae	32.4	147	84	98	MR sp.7	Et-OH 99.5%
480	2010/2/7	32	IKMT-obl	Not Identificatin	9.0	130	60	62	NI	Et-OH 99.5%
490	2010/2/7	34	IKMT-step	Muraeninae	~31.0	130+	58	54	MR sp.3	Et-OH 99.5%
491	2010/2/7	34	IKMT-step	Uropterygiinae	28.5	125	61	61	URsp.3	Et-OH 99.5%
492	2010/2/7	34	IKMT-step	Muraeninae	28.5	129	59	56	MR sp.3	Et-OH 99.5%
501	2010/2/8	35	IKMT-step	Muraeninae	57.7	110	59	57	MR sp.1	Formalin 5%
502	2010/2/8	35	IKMT-step	Muraeninae	67.2	109	59	56	MR sp.1	Et-OH 99.5%
509	2010/2/8	36	IKMT-obl	Uropterygiinae	18.9	124	57	60	URsp.3	Et-OH 99.5%
510	2010/2/8	36	IKMT-obl	Muraeninae	47.3	140	70	76	MR sp.6	Et-OH 99.5%
511	2010/2/8	36	IKMT-obl	Muraeninae	50.0	142	70	77	MR sp.6	Et-OH 99.5%
524	2010/2/9	38	IKMT-step	Not Identificatin	9.6	134+	-	-	NI	Et-OH 99.5%
561	2010/2/9	38	IKMT-step	Not Identificatin	11.0+	150+	98	119	NI	Et-OH 99.5%
565	2010/2/9	38	IKMT-step	Not Identificatin	8.0	-	-	-	NI	Et-OH 99.5%
566	2010/2/9	38	IKMT-step	Not Identificatin	6.7	-	-	-	NI	Et-OH 99.5%
569	2010/2/9	38	IKMT-step	Not Identificatin	6.1	-	-	-	NI	Et-OH 99.5%
573	2010/2/9	38	IKMT-step	Not Identificatin	Egg 3.0	-	-	-	NI	E-vial Et-OH 99.5%
574	2010/2/9	38	IKMT-step	Muraeninae	52.1	139	68	76	MR sp.6	Et-OH 99.5%
575	2010/2/9	38	IKMT-step	Muraeninae	47.9	144	84	95	MR sp.7	Et-OH 99.5%

Leptocephalus food web

Alexandre CARPENTIER, Christine DUPUY, Celine ELLIEN, Eric FEUNTEUN, Mari KUROKI, Raymonde LECOMTE-FINIGER, Michael MILLER, Tsuguo OTAKE, Stéphane POUS, Elodie REVEILLAC, Tony ROBINET, & Katsumi TSUKAMOTO

Leptocephalus diet remains poorly documented and the subject of much debate. This is mainly due to the fact that no zooplankton has been seen in the digestive tract. This observation made that the sources of food remained for a long time enigmatic. Some investigators have suggested that the digestive tract would not be functional that larvae fed on plankton, or on gelatinous plankton (Jellyfishes, Siphonophora, Scyphomedusae, Ctenophores and Appendicularians) or that larvae fed essentially on dissolved organic matter (particulate organic matter, POM and dissolved organic matter, DOM) and on detritical particles. The direct absorption of Dissolved Organic Carbon was also hypothesized but this theory was finally shown to be wrong.

Studies based on Isotope Ratios of N & C showed that the trophic level of several leptocephalus taxa were very low (Otake et al. 1993). Other studies pointed out the presence of ciliates and faecal pellets in gut contents suggesting that these food items could represent key food items for leptocephalus.

The aim of the present study is therefore to clarify the respective roles of particulate organic matter and small organisms as ciliates, copepods, larvae, etc. in the diet of leptocephalus larvae's diets. We also aimed at comparing the diet of fish larvae which to understand if they compete with leptocephalus or if they feed on different food sources. Therefore, we will study C & N stable isotope ratio among various taxa and potential food resources and leptocephali taxa.

To achieve this:

1. We sampled leptocephali larvae which were selected among the families caught during the survey.
2. We filtered water from various depths to select total Particulate Organic Matter at various depths
3. We selected a range of organisms (chaetognath, Copepods and small crustaceans, gelatineous, larvacean houses,...) that may be food items for leptocephali

4. We also selected a range of fish larvae with comparable sizes as leptocephali.

I- Sampling design for leptocephali

A total of 110 leptocephalus larvae were sampled. They were selected among ca. 520 leptocephali larvae sampled during night and day tows. The samples were all preserved in ethanol but processed in different ways according to size. All the details of the preservation are given in the lepto datasheet and summarized below in table1.

1. Small leptos (*ca.* 15 mm) have been preserved in ethanol vials. They will be taken and processed in France. Otoliths will be extracted for oxygen isotope analysis by Raymonde Lecomte for migration pathways study (see relevant section for details). The bodies will be used for C & N isotope analysis by the French Museum and Perpignan University
2. Larger specimens were cut into two parts.
    - The head was preserved in vials, kept on board Hakuho Mary and shipped to Tokyo University for Ageing (Mari Kuroki). For each specimen, one of the otoliths will be ground to core for age reading at the University of Tokyo. The second one will be kept in a vial. Both otoliths will then be sent to France to Eric Feunteun at the French Museum for the study on the migration pathways of leptocephali (see relevant section for details). Molecular studies (Jun Aoyama).
    - The bodies were preserved in ethanol and taken to France at the French Museum by Eric Feunteun for C & N isotope analysis. Work will be done in collaborative work between University of Perpignan and the French Museum.

Table 1. Hakuho Maru Cruise 2010 Leg HK-09-5 sample design. Explanation of the database with samples preservation per family

Family	Preservation	Body part	Aim	Destination	NB of samples
Anguillidae	**F**	Gut	The gut was preserved in formalin for analysis of gut content in Japan (Prof. Otake).	JAPAN	2
	Ethanol	Rear half	The rear half of the body was preserved in ethanol and will go to France (Elodie Réveillac & Eric Feunteun) for stable isotopes $\delta^{13}C$ and $\delta^{15}N$ analysis.	FRANCE (Dinard)	2
	Ethanol	Frontal half including head	The frontal half of the body including the head was preserved in ethanol and will go first to Japan. There, otolith ageing will be performed (Mari Kuroki & Jun Aoyama) on one otolith that will thereafter be used by the French (Elodie Réveillac, Eric Feunteun in coll. with Raymonde Lecomte & Dominique Blamart) for oxygen stable isotopes ($\delta^{18}O$) analysis by ablation with ion probe/nanoSIMS. The second otolith will also be sent to France for in toto $\delta^{18}O$ analysis by mass spectrometry (Raymonde Lecomte & Dominique Blamart in coll. with Elodie Réveillac, Eric Feunteun).	JAPAN and then FRANCE (Dinard & Perpignan)	2
Other Anguilliform leptocephali	**F**	Whole larvae or part of	Formalin preserved larvae were not cut, they will go to Museum collections in Japan and France.	JAPAN & FRANCE (Paris)	42
	E-vial	Whole larvae	Larvae entirely preserved in E-vial with ethanol will go to Japan for genetic analyses.	JAPAN	47
	DNA	Whole larvae or part of	Body or piece of body preserved in ethanol will go to Japan or to France (Tony Robinet).	JAPAN or FRANCE (Paris)	4
	FR	Whole larvae or part of		JAPAN	270

	ISO	Head	Heads of larvae were cut, preserved in E-vial with ethanol and will be sent to Japan for otolith ageing (Mari Kuroki and Jun Aoyama) then both otoliths will be sent to France for $\delta^{18}O$ analyses by ablation with ion probe/nanoSIMS on the right Sagitta (Elodie Réveillac, Eric Feunteun in coll. with Raymonde Lecomte & Dominique Blamart) and for in toto $\delta^{18}O$ and $\delta^{13}C$ analyses by mass spectrometry on the left Sagitta (Raymonde Lecomte & Dominique Blamart in coll. with Elodie Réveillac, Eric Feunteun).	JAPAN and then FRANCE (Dinard & Perpignan)	58
		Body	Bodies of larvae were preserved in plastic bags in ethanol and will be sent to France for analyses of $\delta^{13}C$, $\delta^{15}N$ and $\delta^{18}O$ composition by mass spectrometry (Eric Feunteun, Elodie Réveillac, Raymonde Lecomte & Dominique Blamart). A small piece has been preserved in ethanol for genetic barcoding in French National Museum (Tony Robinet).	FRANCE (Dinard, Perpignan & Paris)	58
	ISO-E-vial	Whole larvae	Entire larvae were preserved in E-vial with ethanol (small specimens) and will be sent to France for stable isotopes analyses of $\delta^{13}C$ (otoliths and body), $\delta^{15}N$ (body) and $\delta^{18}O$ (otoliths and body) by Raymonde Lecomte & Dominique Blamart in coll. with Elodie Réveillac, Eric Feunteun.	FRANCE (Perpignan)	39
	ISO-Lipid	Head	Heads of larvae were cut, preserved in E-vial with ethanol and will be sent to Japan for otolith ageing (Mari Kuroki and Jun Aoyama) then both otoliths will be sent to France for $\delta^{18}O$ analyses by ablation with ion probe/nanoSIMS on the right Sagitta (Elodie Réveillac, Eric Feunteun in coll. with Raymonde Lecomte & Dominique Blamart) and for in toto $\delta^{18}O$ and $\delta^{13}C$ analyses by mass spectrometry on the left Sagitta (Raymonde Lecomte & Dominique Blamart in coll. with Elodie Réveillac, Eric Feunteun).	JAPAN and then FRANCE (Dinard & Perpignan)	4
		Body	One part of the body was preserved in ethanol. It will be processed as in ISO labels. In addition another part of the bodies were frozen and will be taken to France (Céline Ellien) for fatty-acid analyses in comparison with gobies.	France (Paris)	4

As for the migration pathway study, the specimens were chosen in order to address three main questions.

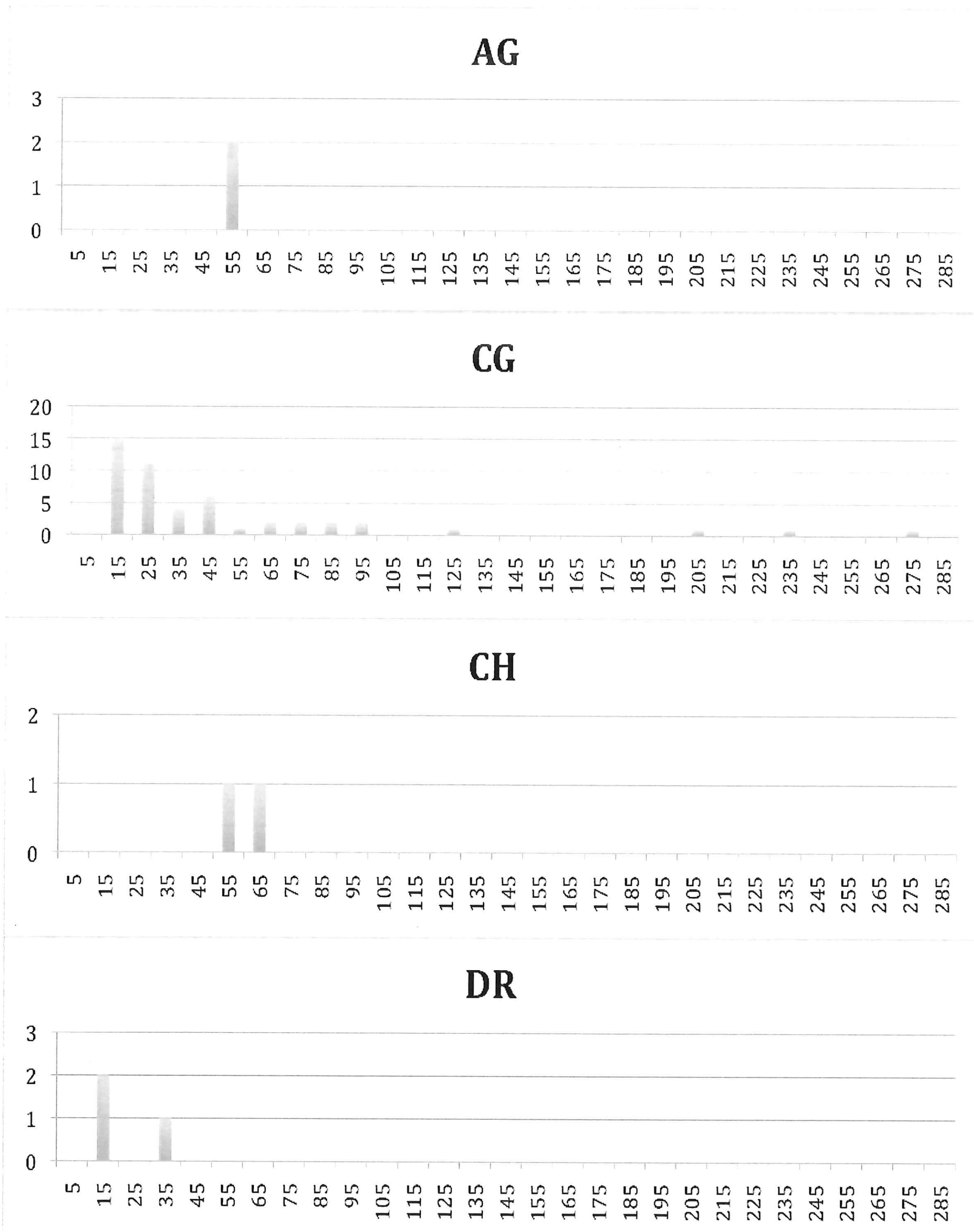
1. Are there differences of trophic level between taxa? To study this question, we selected one to three or more specimens of similar sizes from 9 families (table 2 and figure 1).
2. Does the diet shift according to size and age of leptocephalus and are there different of size / diet patterns among the three main families of anguilliform leptocephalus assemblages (Congridae, Nemichtyidae and Serrivomeridae) ? In this case, we selected 49 serrivomeridae, 29 nemichtyidae and 18 serrivomeridae. There size range of selected specimens was similar to those of the whole sample (table 2 and figure 1).
3. Are there spatial differences of leptocephalus diets in the south west Indian Ocean? This question will be addressed by comparing results from different stations.

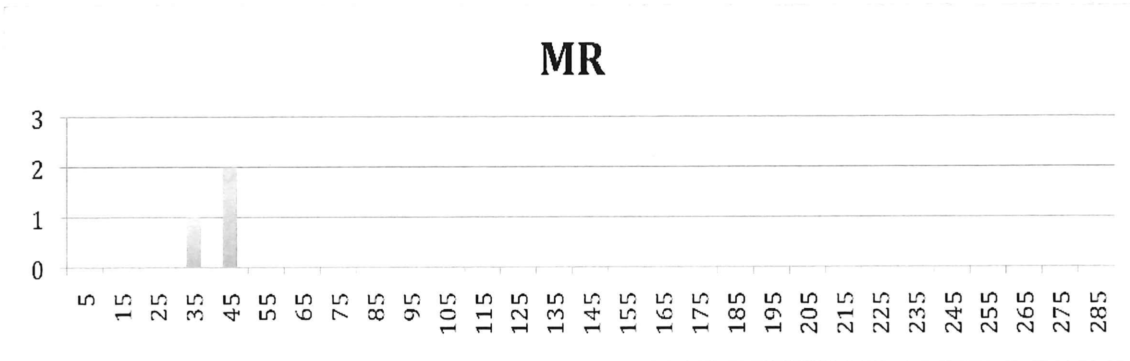
The sample design

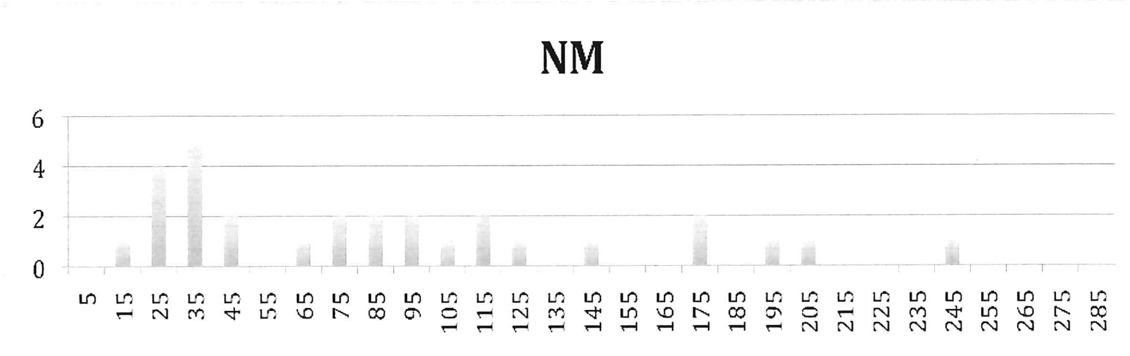
Table 2. Number of individuals caught per family in each station that will be sent to France for stable isotopes composition analyses in otoliths and body tissues, according to Table 1. AG = Anguillidae; CG = Congridae; CH = Chaupychthidae; DR = Derrichthidae; NM = Nemichthydae; OP = Ophichthydae; SR = Serrivomeridae; TH = Thallassonchelys.

Station number	AG	CG	CH	DR	MR	NM	OP	SR	TH	Total
3		14	2			7		5	1	**29**
7		6				5		3		**14**
8					2					
10	1									**1**
11		3		1		6		4		**14**
13		6								**6**
15		2				5		2		**9**
16					1					
19	1	1				3		3		**8**
23		10		2		1	1			**14**
25							1			**1**
27		3								**3**
31		1								**1**
34		2					1	1		**4**
38		1				2				
Total	**2**	**49**	**2**	**3**	**3**	**29**	**3**	**18**	**1**	**110**

Figure 1. Histograms of size class frequencies (number of individuals) per family that will be sent to France for stable isotopes analyses. AG = Anguillidae; CG = Congridae; CH = Chaupychthidae; DR = Derrichthidae; NM = Nemichthydae; OP = Ophichthydae; SR = Serrivomeridae; TH = Thallassonchelys.




MR
3
2
1
0
5 15 25 35 45 55 65 75 85 95 105 115 125 135 145 155 165 175 185 195 205 215 225 235 245 255 265 275 285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4
2
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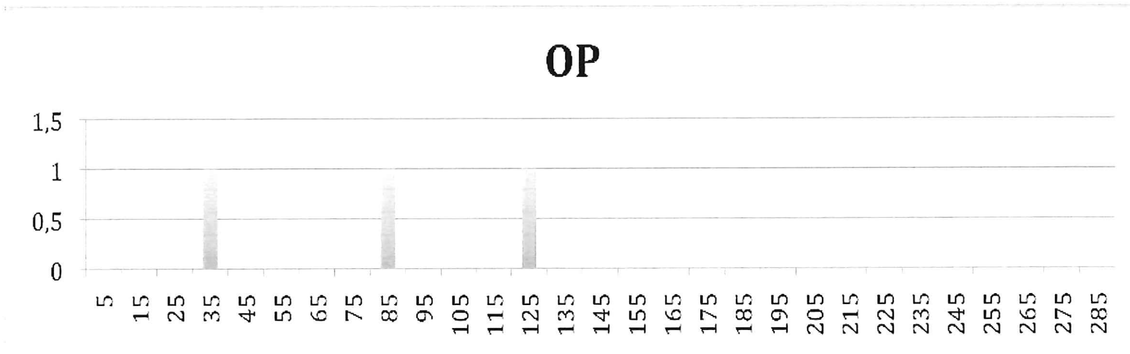
5 15 25 35 45 55 65 75 85 95 105 115 125 135 145 155 165 175 185 195 205 215 225 235 245 255 265 275 285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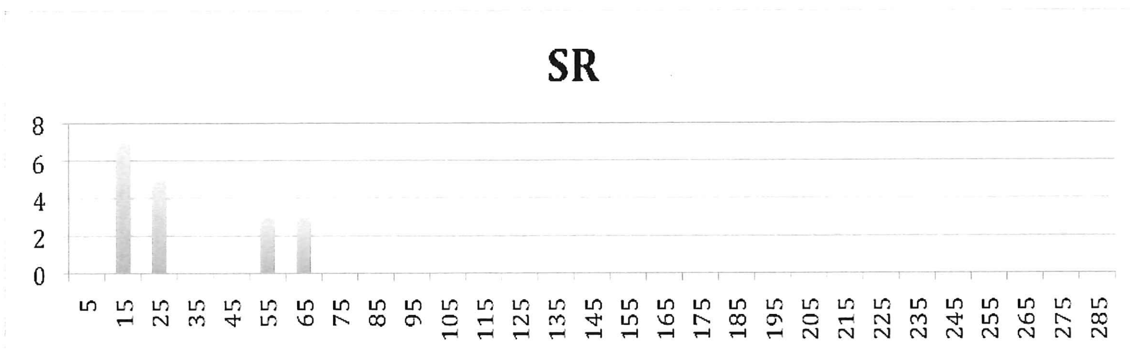
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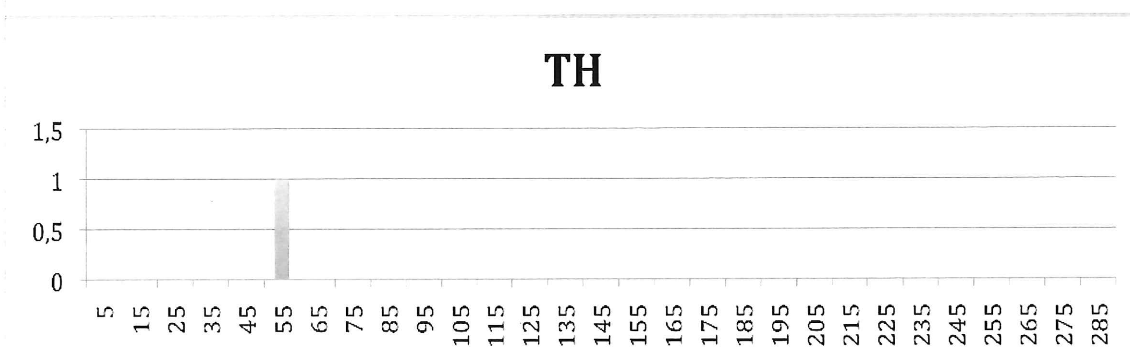
TH
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5 15 25 35 45 55 65 75 85 95 105 115 125 135 145 155 165 175 185 195 205 215 225 235 245 255 265 275 285

3. SWIO FOOD WEB study

Report of the cruise Hakuho-Maru-09-5: Alexandre Carpentier, Christine Dupuy, Eric Feunteun, Mari Kuroki, Michael Miller, Tsuguo Otake, Stephane Pous, Elodie Reveillac, Tony Robinet, Katsumi Tsukamoto, Shun Watanabe

The Table 3 is a summary of the action, number of the samples during the cruise.

Table 3: Summary of the number of samples during the cruise

N° Station	Chlorophyll *a* by size class (>20µm, 5-20µm, <5 µm)	Microplankton (40-300 µm) analysis with flowcam	Stable isotopes of water by size class (<200µm and <5 µm)	Stable isotopes of mesozooplankton	Stable isotopes of fish larvae	Stable isotopes of small fishes	Prokaryote diversity
1	12	4	15	4	74	20	
2				8			
3	12	4	16	6	74	20	
6	12	4	16	6	74	20	
7				6			
10	12	4	16	6	74	20	4
12				2			
13	12	4	16	7	74	20	
15	9	3	12	10	74	20	3
18	12	4	16	2			
19				1	74	20	
21					74	20	
25	12	4	16	4	74	20	
27	12	4	16	5	74	20	5
29				1			
30	12	4	16	7	74	20	
33	12	4	16		74	20	
35	12	4	16	10	74	20	
38	12	4	16	7	74	20	
40	12	4	16	8	74	20	
Total	**165**	**55**	**219**	**100**	**1110**	**300**	**12**
Analysis	University of La Rochelle	University of La Rochelle	University of La Rochelle	CRESCO Dinard and University of La Rochelle	CRESCO Dinard and University of La Rochelle	CRESCO Dinard and University of La Rochelle	University of La Rochelle

<u>DETERMINATION OF THE SIZE STRUCTURE OF THE PRIMARY PRODUCTION USING ANALYSIS OF CHLOROPHYLL *A* BY SIZE CLASS</u>

Total chlorophyll: for each depth (100m, max fluo, 50m and 5m)

1) Filtration of 2L of seawater on nylon net 200 µm. Recuperation of filtrated water.
2) Filtration on GF/F (water pump). Fins were used to recuperate the filter which does not be manipulated by fingers to prevent any contamination.
3) Filter was placed in an Eppendorf and kept frozen at – 20 °C.

Chlorophyll per size class: fraction 5-20 µm / fraction < 5 µm, for each depth

1) Filtration of 2L of water on nylon net 20 µm. Recuperation of filtrated water.
2) Filtration on 5µm filter (Erlen + water pump). Fins were used to recuperate the filter which does not be touched by fingers. Recuperation of filtrated water.
3) Filtration on GF/F (water pump). Use fins to recuperate the filter.
4) Filter was placed in an Eppendorf and kept frozen at – 20 °C.

The frozen filters will be analyzed at the University of La Rochelle. The concentration of chlorophyll by size class (> 20 µm, 5-20 µm, < 5 µm) will be expressed by µg chlorophyll a/L. It will be possible to convert the chlorophyll *a* in carbon biomass (by a conversion factor found in the literature).

DESCRIPTION AND QUANTICATION THE MICROPLANKTONIC COMMUNITY (40-300 µM) USING FLOWCAM TECHNOLOGY

1) For each depth, a NISKIN bottle (12L) has been filtrated on a nylon net of 63 µm.
2) Recuperation of filtrated materials on the net with 0.2 µm filtrated seawater. It has been placed in a vial with 25 ml of 0.2 µm filtered seawater. At the beginning of the cruise, until station 18, the flowcam was not operational. Then, samples were fixed by formalin (5% final concentration). The fixed samples will be analyzed in the University of La Rochelle. From the station 25, the samples were immediately analyzed *in vivo* by flowcam. In addition, samples were recuperated and fixed by formalin (5% final concentration) for conservation in the laboratory.

The determination, concentration, biomass, size spectral of organisms and detritic particles between 40 and 300 µm will be determined in the University of La Rochelle.

DETERMINATION OF THE STRUCTURE OF FOOD WEB WITH SAMPLES OF WATERS (2 SIZE CLASSES) FROM NISKIN BOTTLES, MESOZOOPLANKTON AND FISHES FROM IKMT TRAWLS

Estimation of isotopic ratios of water for each depth

This action is complementary to the work of Raymonde Lecomte.

1) Filtration of 400 ml water on nylon net 200 µm. Recuperation of filtrated water.

2) Filtration of 180 ml of water on burned GF/F (3 x 60 ml with a syringe). Fins were used to recuperate the filter which does not be touched by fingers to prevent any contamination.

3) Filter was put in an Eppendorf and kept frozen at -20°C. It was been twice conducted for a replicate.

4) Filtration of 400ml on 5 µm filter (Erlen + water pump).

5) Filtration of 180 ml of water on burned GF/F (3 x 60 ml with a syringe). Fins were used to recuperate the filter which does not be touched by fingers.

6) Filter was put in an Eppendorf and kept frozen at -20°C. It has been twice conducted for a replicate.

The isotopic ratio (C and N) will be determined for these size classes of particles in the water. The work will be made in the University of La Rochelle.

Estimation of isotopic ratios of mesozooplankton, larvae fishes and small fishes

Mesozooplankton was collected from IKMT trawls and sampled in order to perform stable isotopes (C and N) analysis. This action is complementary to the work of Raymonde Lecomte. Fishes were selected by Tony Robinet and Alexandre Carpentier. Organisms were selected in different group for the mesozooplankton and 5 common groups for the fishes and preserved in absolute ethanol (see Table 4).
The samples are taken by Alexandre Carpentier and Eric Feunteun to prepare the analysis of stable isotopes. These analyses will be made in the CRESCO Dinard and in the University of La Roche lle.

Table 4: Number of mesozooplankton organisms and fish specimens sampled by IKMT trawls for analysis of stable isotopes

Type	Number per station where sampling water
Copepods	30 specimens
Isopodes	50 specimens
Ostracodes	50 specimens
Small and large shrimps	depend of the size, 3 to 10 specimens
Mysis of crustacean	30 specimens
Larvae of crustacean	30 specimens
Chaetognathes	depend of the size, 3 to 20 specimens
Siphonophora	10 specimens
Jellifish	10 specimens
Larvae fishes	74 specimens
Small fishes	20 specimens

PROKARYOTE DIVERSITY

Prokaryote diversity: for each depth

1) Filtration of 1 to 3L of water on 0.2 µm filter (water pump). Fins were used to recuperate the filter which does not be touched by fingers to prevent ant contamination.

2) filter has been stored in an Eppendorf and kept frozen at -20°C.

These analyses will be made at the University of La Rochelle.

DATA OF THE CRUI SE NECESSARY :

- Profile of CTD and Chelsea fluorimeter
- Depth of the Niskin bottles water sampling
- Diversity, distribution and abundance of Leptocephale larvae and other groups of mesozooplankton (copepods, jellyfishes, chaetognathes, crustacean larvae,

fishes) of IKMT trawls.

TOTAL DOC Analysis.

In addition to the previous, total DOM was sampled in the following way. Samples are processed by Raymonde Lecomte on board, and taken to Perpignan University for isotope analysis.

- collect 2 litres of water at various depths (surface and at the fluorescence max)

- filter this water on GF-F Whatman filters

-dry the filters in oven during 12 hours

- preserve the filters (at obscurity in Aluminium paper) at 4°C

and then, back to laboratory to measure the C and N isotope ratios with spectrometry (GV Isoprime spectrometer at University of Perpignan in col. with P. Kerherve)

Each sample was done at station

1, 3, 6, 10, 13, 15, 18, 21, 22, 25, 27, 30, 33, 38

Gobiidae larvae dispersion

Celine Ellien, Shun Watanabe, Stephane Pous, & Katsumi Tsukamoto

The main purpose of our participation in the KH-09-5 Leg 5 cruise on the R/V Hakuho Maru, was to improve our knowledge about the marine larval stage of amphidromous Gobiidae, and particularly on the Gobiidae larvae of the family Sicydiinae, for which little is known.

Two aspects will be particularly studied, based on the samples obtained during this cruise:

1) The location and abundance of the larvae in the southwestern Indian Ocean (SWIO)
2) The larval life history traits, with a particular attention given to their feeding behaviour

I. Location and abundance of Sicydiinae larvae in the SWIO

During the sorting activity on board, a particular attention was given to the Sicydiinae larvae, and we attempted to identify them based on morphological criteria such as pigmentation, shape of the eye, and shape of the dorsal fin. The shape of the pelvien fin was more difficult to assess at this preliminary step of observation, even if it is the most determinant characteristic at the adult stage for the Gobiidae.

According to these criteria, some larvae have been identified as Sicydiinae larvae, but this has to be confirmed by genetics, once back in the laboratory. Note that sequence primers of Clara Lord (MNHN, Paris) will allow us to confirm or reject the identification of the sampled individuals as being of the Sicydiinae.

All the sampled individuals have been frozen (at a temperature of –80°C) for further analysis.

Table 1. Locations, abundances and total lengths (TL) of the Sicydiinae larvae sampled during the cruise, associated with their reference numbers. An indication of the corresponding photograph number is given when it exists.

Station number	**Abundance**			
12	**17**			
		Reference number	**TL (mm)**	**Photo number**
		KH 09-5 St12_1	9	
		KH 09-5 St12_2	9	
		KH 09-5 St12_3	23	
		KH 09-5 St12_4	10	St12-001
		KH 09-5 St12_5	9	St12-004 →St12-005
		KH 09-5 St12_6	9	
		KH 09-5 St12_7	13	St12-006 →St12-007
		KH 09-5 St12_8	9.5	
		KH 09-5 St12_9	11	

		KH 09-5 St12_10	19	St12-008 →St12-009
		KH 09-5 St12_11	11	St12-010 →St12-011
		KH 09-5 St12_12	17	St12-012 →St12-013
		KH 09-5 St12_13	14	
		KH 09-5 St12_14	20.5	
		KH 09-5 St12_15	18	
		KH 09-5 St12_16	17	St12-014 →St12-015
		KH 09-5 St12_17	27	St12-016 →St12-019
15	**1**			
		KH 09-5 St15_1	13.5	St15-001 →St12-007
19	**1**			
		KH 09-5 St19_1	10	St19-045 →St19-113
23	**7**			
		KH 09-5 St23_1	14	
		KH 09-5 St23_2	13	
		KH 09-5 St23_3	15	
		KH 09-5 St23_4	14.5	
		KH 09-5 St23_5	16	
		KH 09-5 St23_6	18	
		KH 09-5 St23_7	15	
34	**3**			
		KH 09-5 St34_1	10	
		KH 09-5 St34_2	11	St34-001 →St34-002
		KH 09-5 St34_3	9.5	St34-003 →St34-006
35	**2**			
		KH 09-5 St35_1	17	
		KH 09-5 St35_2	15	St35-001 →St34-006
37	**5**			
		KH 09-5 St37_1	25	St37-061 →St37-064
		KH 09-5 St37_2	20.5	
		KH 09-5 St37_3	10	
		KH 09-5 St37_4	11	
		KH 09-5 St37_5	8	
39	**2**			
		KH 09-5 St39_1	16	
		KH 09-5 St39_2	12	

Note that for station 37, the individuals referred to as KH 09-5 St37_1 and KH 09-5 St37_2 have a pelvien fin characteristics that look like those of Eleotridae.

A map will summarise the obtained data of the locations and abundances of the sampled larvae, once their identification is confirmed.

Photos will be recorded in the database of Fishbase, if the larvae are proved to belong to the Sicydiinae and the best looking individual will be used for the National Museum of Natural History (Paris) collections.

II. Study of the larval biology

Once in the lab in Paris, the otoliths will be extracted to assess the larvae age, and a correlation and a regression model between total length and age will be made, if the final number of individuals is sufficient (after confirmation of their identification by genetic analysis).

Most importantly, their feeding behaviour will be analysed through fatty acid analysis. For that purpose, individuals will be analysed through the standard protocol of fatty acid extraction and gas chromatography.

During the cruise, water was sampled at the depth of the maximum fluorescence, which is the depth where most of the planktonic organisms (both phyto- and zooplankton) can be found. The water has been filtered on 0.7 μm mesh size GF/F filters in order to retain the smaller size organisms such as phytoplankton, dinoflagellates etc.

The obtained filters have been frozen (at a temperature of –80°C), and C. Elliene will process fatty acids analysis on them, once back in Paris. The objective is to infer the fatty acids profiles of the larvae with the fatty acid profile of their environment, to have some indication of what the larvae feed on. The fatty acid analyses give information on the diet of the organisms for the 2 to 3 weeks before their capture, as fatty acids are metabolised and then stored in muscles or organs after assimilation.

As the filters didn't retain mesoscale organisms, a spoon of "soup" was also kept (i.e. what we collected in the IKMT net, after the sorting out of fish larvae, gelatinous plankton...) at some stations (i.e. St. 23, St. 37...) where Gobiidae larvae were found, and was frozen, for fatty acid analyses later. This may provide complementary fatty acid profiles, and complete the data on filtered water, to have full concordance with the fatty acid profiles of larvae.

As the feeding behaviour of the larvae depends on the size of their mouth, this parameter has been photographed in detail, to make inferences with plankton size. It is hoped that this and the other types of data collected during the cruise will allow the diet of Sicydiinae larvae to be determined.

Report on the Parasitofauna of Mesopelagic Fishes

Betty Faliex and Elsa Amilhat

The study of biodiversity and its preservation has been a growing concern in the scientific community for about fifteen years. In this context, the study of the biodiversity of parasites from mesopelagic fishes is of particular interest, as according to several authors, it is largely underestimated. Mesopelagic fish parasites have been often neglected, although they represent an integral part of the mesopelagic environment and form an essential part of marine biodiversity.

The objective of this work is to give a first overview of the biodiversity of mesopelagic fish parasites in the southwestern Indian Ocean.

During the 2010 Leg 5 cruise of KH-09-5 on Hakuho Maru, we dissected 72 fish (juveniles and adults) belonging to at least 11 groups (Table 1). For each fish, gills, digestive tract and body cavity were investigated for macroparasites. A total of 41 parasite specimens were recorded that belong to 4 groups: Nematoda (8), Monogenean (2), Digenean (7), Cestoda (11) and 6 types of parasites that are still unidentified (24). Nematodes were preserved in ethanol, Monogeneans and Digeneans were fixed in Bouin solution and Cestoda larvae preserved in 10% formalin. Photographs from both fish and the parasites have been taken.

All the otoliths of the dissected fish were collected. Although, because of the small number of parasitized fish, we may not be able to link otolith shape with parasitism levels. However, we will analyse the shapes of the otoliths collected and photos of the otoliths will be taken with SEM to document otolith shape biodiversity of mesopelagic fish of the southwestern Indian Ocean.

Even if leptocephali could not be dissected for parasite research, we consider that their observation under the stereomicroscope would have detected any encysted parasites larvae. Thus, three unidentified external parasites have been found on 3 different leptocephali belonging to the families Serrivomeridae, Congridae and Ophichthidae. The parasites were preserved in alcohol. The serrivomerid leptocephalus was preserved in formalin for morphological identification of the parasite.

In addition, we found digenean parasites in the body cavity of a chaetognath. These parasites were preserved both in ethanol and formalin for morpho-anatomical examination.

All the parasites will be brought back to Perpignan for further identification.

Table 1. Details of the fishes and chaetognaths investigated for the presence of parasites during KH-09-5 Leg 5 to the west of the Mascarene Ridge in the southwestern Indian Ocean.

Fish group	**No. of fish studied (standard length in cm)**	**% of infected fish**	**Parasites**	**Stations**
Brama myersi	2 (3.8-4.7)	0	0	14,22
Carangidae	8 (6 -8.5)	12.5	1 monogène Polyopisthocotylea adult 17 unidentified parasites	27,31
Chauliodus sp. (*macouni* ?)	2 (6.2-14.6)	0	0	20,37
Chiasmodontidae (*Pseudoscopelus scriptus sagamianus*)	1 (5.7)	0	0	28
Gonostomatidae	5 (6-18)	20	1 cestode larvae 1 nematode larvae	24,26
Melanostomidae	7 (5.3-24.7)	28.6	2 digenea adults 1 cestoda larva 1 cestoda adult diphyllidea?	3,19,23,30,37,38
Myctophiformes	38 (2.4-7)	39.5	4 digenea adults, 1 undet. Parasite, 7 cestoda larvae, 6 nematode larvae and 1 monogenea	4,7,8,11,12,16 17,19,23,24,28,31 32,34,35
Saccopharyngidae	1 (2.4)		0	
Undetermined fish N°1 and N°2	2		1 cestode larvae on N°1	21,35
Undet. fish larvae	3		3 undetermined external parasite 1 digenean metacercaria encysted in the flesh	23,34
Leptocephali (Serrivomeridae, Congridae, Ophicthidae)	3	0.005	1 undet. external parasites N°1 and 2 undet. external parasites N°2	3,37,38
TOTAL	**72**		**41**	
Chaetognathe	About 100	Around 6%	6 digenea adults	35,36,38

Diversity of fish larvae west of the Mascarene Ridge in the Southwestern Indian Ocean

Tony Robinet, Mari Kuroki, Alex Carpentier, Michael J. Miller,
Katsumi Tsukamoto, and Tsuguo OTAKE

During the KH-06-4 sampling survey in the same region as the present cruise, the diversity of leptocephali larvae of Anguilliformes was studied in the western Indian Ocean by describing the structure of the species assemblage of more than 500 leptocephalus larvae, but this analysis was restricted to anguilliform larvae.

The species identification of most of the other fish larvae in the ocean offshore of Madagascar and to the west of the Mascarene Ridge is difficult due to the lack of taxonomic characters in the early life stages of many fishes. However, species identification is now possible as a routine technology by DNA sequencing (barcoding: COI etc.) in the laboratory.

During the present cruise all the other fish larvae (non-anguilliforms) were therefore systematically sorted out of the plankton of each tow (step and oblique tows). High resolution digital pictures were taken of some specimens with stereo microscopes aboard and these were kept individually in 99% ethanol (for future DNA sequencing). When more than one of a species was collected, specimens were preserved in 10% formalin (for morphological description). In other cases specimens were presorted and preserved in ethanol.

The number of larvae collected (excluding anguilliform leptocephali) is estimated to be up to 5,000, among which 500 were pictured and preserved individually. All of the larvae will be brought back to the University Museum of the University of Tokyo (Dr. Kuroki) and then shared with the National Museum of Natural History in Paris (Dr. Robinet), to be identified to the lowest taxonomic level possible.

The objectives of this study are:

1) To supply collection material of fish larvae from this particular region to the museums in France and Japan.
2) To analyze the variability of species assemblage according to sampling depth, latitude, and night/day time.
3) To provide information on unidentified small fish larvae using DNA sequences and to link the successive development stages in the poorly known groups of mesopelagic fishes.

Moreover, the expected species composition of the fish larvae collected during KH-09-5 will provide specimens to other ongoing research in fish science (tunas, swordfish, Gonostomatidae etc.). The photographs shared between France and Japan from this cruise can also eventually be used to update photographic databases at the museums or other organizations.

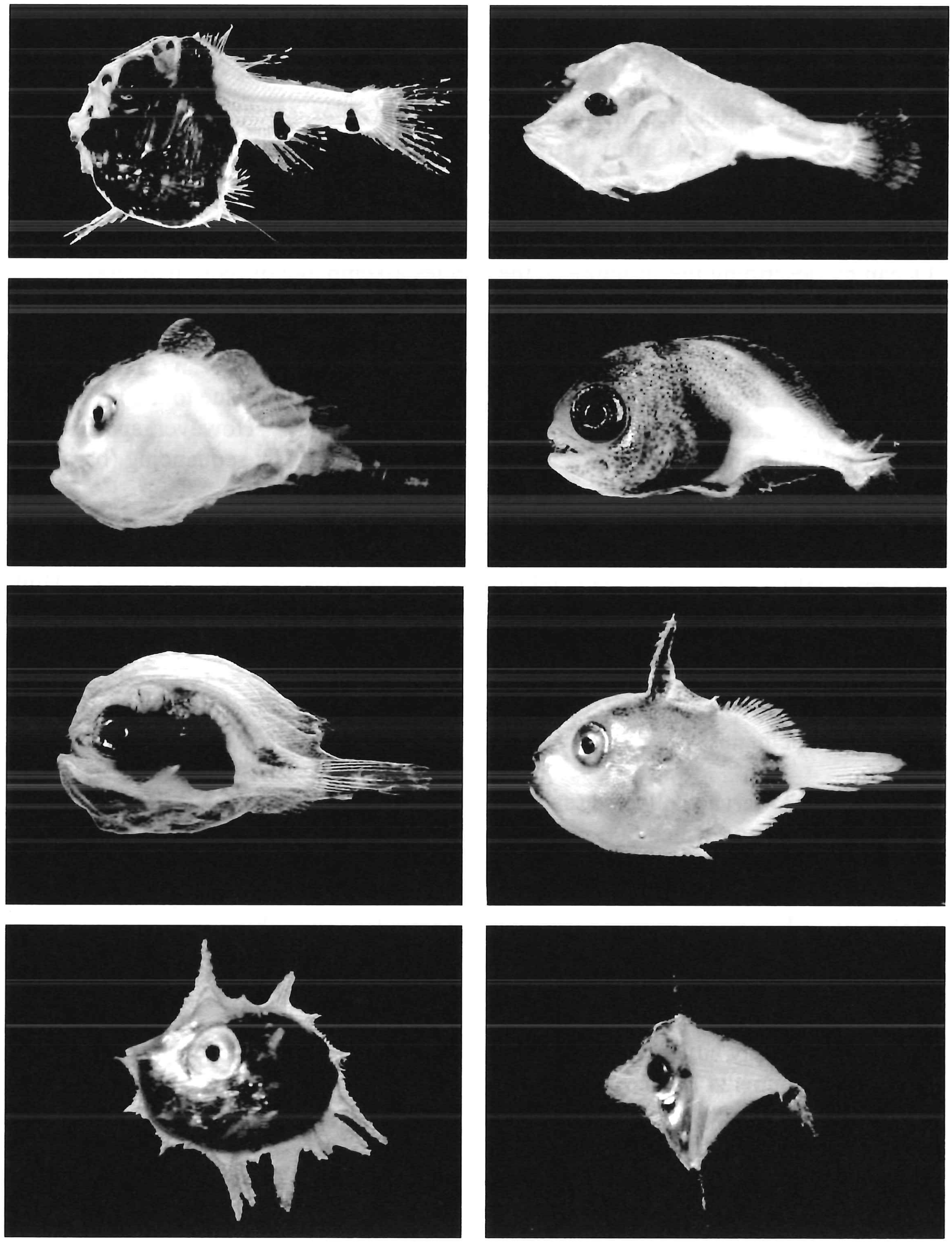

Figure 1. Various fish larvae collected with the IKMT during the KH-09-5 sampling survey west of the Mascarene Ridge, including a hatchetfish, anglerfish, triggerfish, and an ocean sunfish/moonfish/mambo (e.g. *Mola mola*) in the bottom left panel.

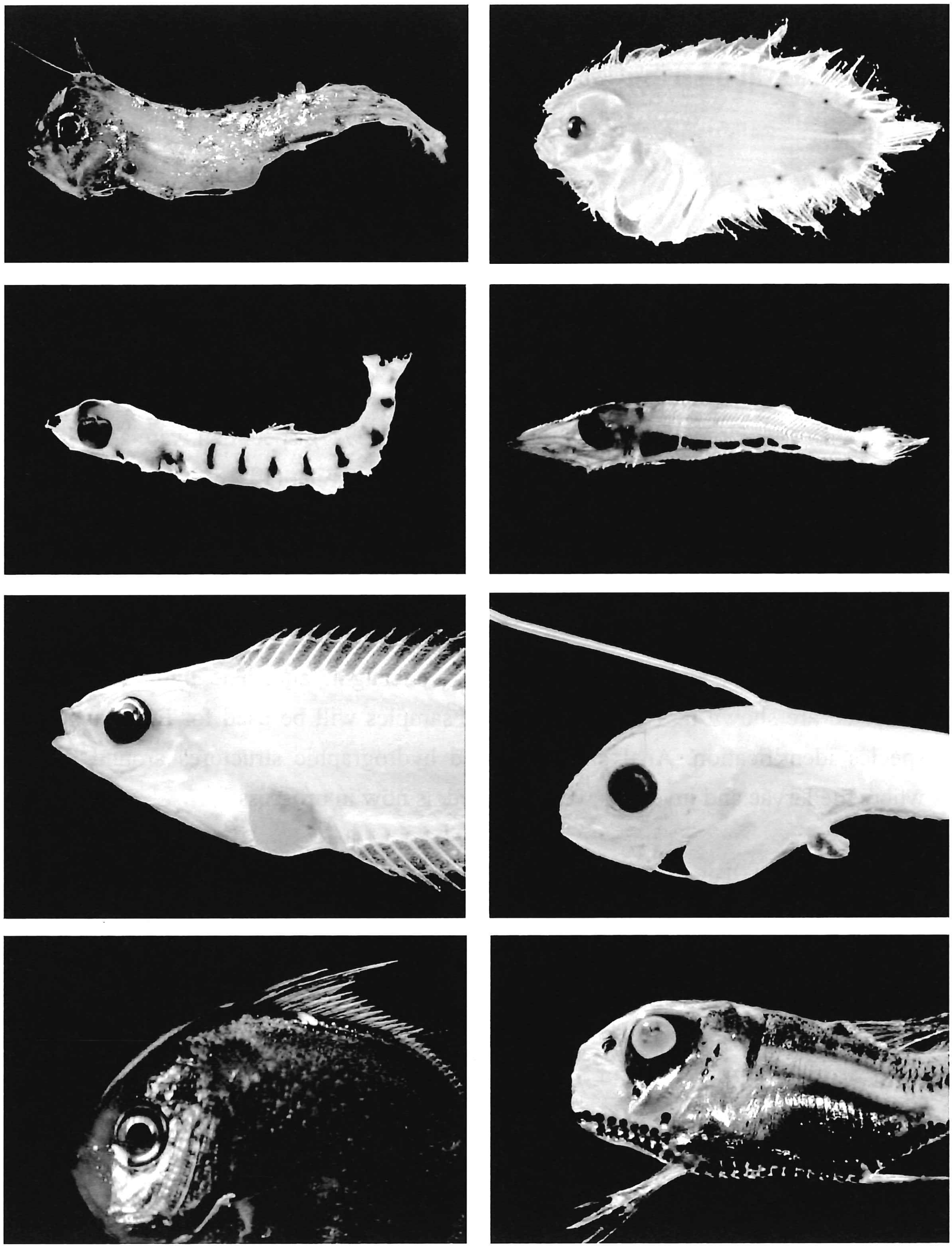

Figure 2. Various other fish larvae collected with the IKMT during the KH-09-5 sampling survey west of the Mascarene Ridge, including a labrid, flatfish, etc.

Larval distribution and population structure of *Thunnus* in the Indian Ocean

Takashi Kitagawa

Scombridae contains 15 genera including *Thunnus*. The genus *Thunnus* contains eight species. In the Indian Ocean, yellowfin (*T. albacares*), bigeye (*T. obesus*), southern bluefin tuna (*T. maccoyii*) and albacore (*T. alalunga*) are distributed, but larval distributions and population structures of those species are not still unknown.

During 29 January- 9 February 2010 (KH-09-5), specimen were sampled at 40 stations in the area northern part of the EEZ of Mauritius (13-18°S, 54-60°E) with the Issacs Kidd Midwater Trawl (IKMT) with an 8.7 m^2 mouth opening and 0.5 mm mesh. Oblique and step tows were carried out during the day and night, respectively. CTD (+CMS) observation was also conducted. Details of the net tows and CTD casting are shown somewhere in this cruise report.

Tuna like larvae and juveniles were caught, and. The number of samples collected are shown in Table 1. All of the samples will be used for DNA analysis for species identification. Analysis of detailed hydrographic structures around the areas where the larvae and juveniles were sampled, is now in progress.

Table 1: Tuna samples collected during 29 Jan- 9 Feb 2010 (KH-09-5),

St.1	1	St.2	12	St.3	6	St.7	10
St.8	4	St.11	4	St.13	2	St.15	9
St.17	2	St.19	16	St.23	2	St.24	3
St.25	2	St.27	12	St.28	11	St.30	1
St.31	27	St.34	6	St.37	18		

Studies on feeding ecology of phyllosoma larvae of palinurid and scyllarid lobsters

Masamichi MACHIDA and Shuhei NISHIDA

Introduction

The larvae of palinurid and scyllarid lobsters are called "phyllosoma", with their transparent and flattened bodies. Phyllosoma larvae are distributed in open ocean、 with long planktonic period for over 6 months. Their prey items in national environment have been mostly unknown because their low natural density has made wild specimens difficult to be captured for experimental observations. The main purpose of the present cruise is to collect phyllosoma larvae for analyses of stable isotope ratios, fatty acid composition and gut contents, and for species identification using genetic markers.

Phyllosoma, plankton and POM sampling

A total of 28 phyllosomas was corrected using an Isaacs-Kidd Midwater Trawl (IKMT, 0.5mm mesh aperture) towed obliquely, horizontally or step-wise during Legs 5 and 6 (Table 1). Phyllosomas were sorted from the original zooplankton samples immediately after capture. These phyllosomas were fixed or frozen for the respective analyses as described below.

Sea-water samples were collected from 0, 50, 100, 200 m and the depths of chlorophyll maximum, and POM (particulate organic matter) was filtered on pre-combusted GF/F filters which were then preserved at -80°C.

Food habitats of phyllosoma

Studies of mouthpart and gut morphology of phyllosoma larvae have suggested that they are suited for feeding on soft foods such as gelatinous zooplankton (Nishida et al., 1990; Johnston and Ritar, 2001). DNA analyses of gut contents have identified Cnidaria and Urochordata (Suzuki et al., 2006) as potential food sources. On the basis of these bodies of information, we collected gelatinous zooplankton samples (Cnidaria, Ctenophore, Chaetognatha, Heteropoda, Thecosomata, Gymnosomata, Thaliacea, Salpida) , net zooplankton mixture (random sampling) and POM for analyses of stable isotope ratios and fatty-acid composition to estimate trophic levels of phyllosoma. These samples and sorted phyllosomas were identified to genera, families, or higher taxonomic groups and frozen at -80°C for the analyses on land. Some other phyllosomas were frozen or fixed in 100% alcohol for genetic identification of gut-contents, or fixed in 2% formaldehyde or in Karnovsky's fixative for light/electron microscopic observation on feeding structure and gut contents.

Species identification of phyllosoma with genetic markers

It is difficult to identify the species of scyllarid phyllosomas , due to the limited morphological information that are available only for the final stage larvae in most species. Identification at the genus level is also difficult, particularly between *Parribacus* and *Scyllarides*, by morphological characteristics. Genetic species identification of invertebrate is often possible on the basis of mitochondrial cytochrome oxidase subunit I (COI) and/or 16S rDNA genes, coupled with a GenBank homology search. However, COI and 16S rDNA references of scyllarid lobsters are still very incomplete. With this circumstance, we aimed at obtaining sequence references and morphological characteristics of the scyllarid lobsters. Some of the sorted scyllarid phyllosomas were identified to possible lowest levels and preserved in 100% alcohol for genetic analysis, while some other specimens were fixed and preserved in formaldehyde as references for morphological analysis.

Table 1. Number of phyllosoma larvae collected during Legs 5 and 6 of KH-09-5 cruise.

	KH-09-5, Leg5	Leg.6	Total
Panulirus spp.	4	15	19
Scyllarinae spp.	1	1	2
others	2	5	7
Total	7	21	28

Geographic Variation in the Assemblage Structure and Life Histories of Leptocephali across the Indian Ocean Basin

Michael J. Miller, Jun Aoyama, Shun Watanabe, Eric Feunteun, Sam Wouthuyzen, Augy Syahailatua, Tsuguo Otake, Katsumi Tsukamoto
and various other cruise members

During Leg 6 of the KH-09-5 cruise in 2010, which was scheduled primarily as a transit cruise to cross the Indian Ocean from Mauritius to Benoa of Bali Indonesia, 12 IKMT stations were also made during nighttime (Figure 1). These tows collected more than 1,100 leptocephali and consisted primarily of mesopelagic eel leptocephali from Stn. 1 to Stn. 10, and then were dominated by the leptocephali of shallow water eels at Stn. 11 and 12. Multiple tows were made at Stn. 12 where many ophichthids, congrids and moringuids were collected.

These collections made during Leg 6 of KH-09-5 will combined with the transect of 20 stations that was made in 2006 during KH-06-4 across the Indian Ocean (Figure 1) along with the sampling that was conducted to the west of the Mascarene Ridge in both years also, to gain understanding of the dynamics of marine eel life histories in this semi-enclosed ocean basin in relation to ocean current patterns and the temperature structure of the surface layer where leptocephali live and feed.

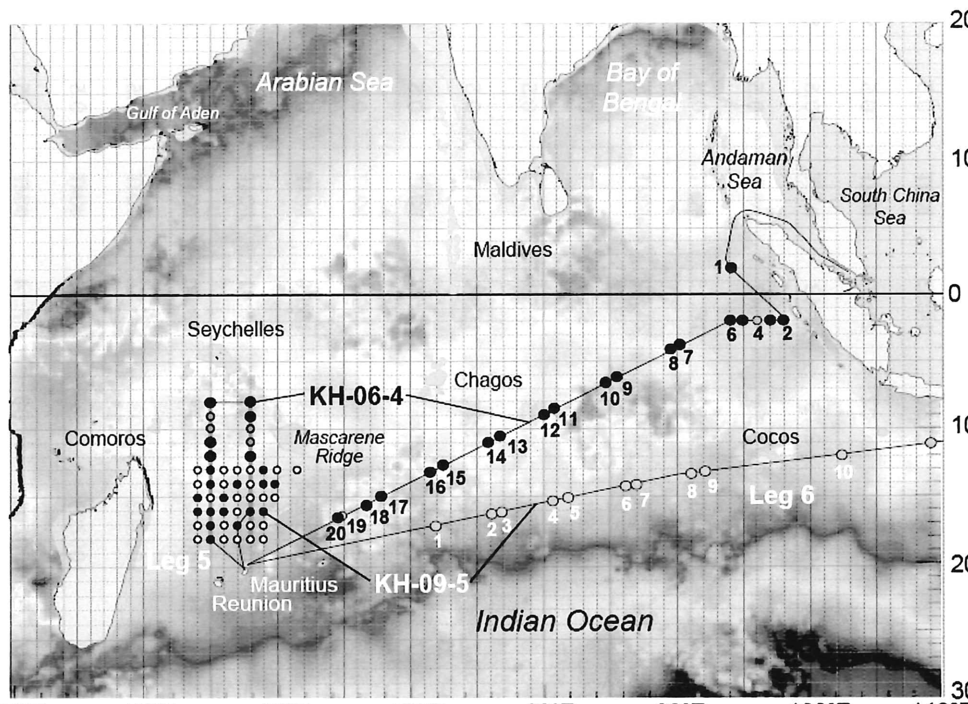

Figure 1. Map showing the sampling stations of the KH-06-4 and KH-09-5 sampling surveys for leptocephali. White and red circles in the Mascarene Ridge region show day tows, but most other stations are night tows in the rest of the map. Red lines show the transects sampled west of the Mascarene Ridge in 2006, with half of the stations overlapping with the 2010 sampling grid. Stn. 12 of KH-09-5 Leg 6 is just off the map. The station map is plotted over sea surface temperature for 14 January 2010 a few weeks before the start of Leg 5 of KH-09-5, obtained from the US Navy NRL.

KH-09-5 Net Record Leg 5

St.	Location		Date	Time		Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Sea Depth (m)
	Net in	Net out		Net in	Net out								
1	S 18-00.1 E 54-01.6	S 17-57.4 E 54-01.2	100130	07:12	08:37	IKMT	0.5	Obl.	1542	0-527	1.0-0.5	2.5-2.0	4654-4782
2	S 17-00.4 E 54-02.4	S 16-59.0 E 54-03.0	100130	13:50	14:55	IKMT	0.5	Obl.	1185	0-513	1.0-0.5	2.5-2.0	4708-4725
3	S 15-59.8 E 54-02.1	S 15-56.0 E 54-01.8	100130	20:02	21:33	IKMT	0.5	Step	534	0-155	1.0-0.5	2.5-2.0	4516-4566
4	S 14-59.8 E 54-01.8	S 14-56.7 E 54-01.2	100131	2:15	3:43	IKMT	0.5	Step	585	0-160	1.0-0.3	2.5-2.0	4500-4592
5	S 14-00.3 E 54-02.3	S 13-58.4 E 54-02.1	100131	8:39	9:47	IKMT	0.5	Obl.	1265	0-521	1.0-0.5	2.5-2.0	4216-4264
6	S 13-00.2 E 54-02.0	S 12-57.4 E 54-02.4	100131	14:52	16:13	IKMT	0.5	Obl.	1506	0-618	1.0-0.5	2.5-2.0	4605-4628
7	S 12-59.8 E 55-00.0	S 12-58.4 E 54-56.5	100131	20:16	21:47	IKMT	0.5	Step	344	0-153	1.0-0.3	3.0-1.5	3878-4215
8	S 13-59.9 E 54-59.9	S 13-58.2 E 54-57.3	100201	2:16	3:55	IKMT	0.5	Step	554	0-157	1.0-0.3	2.5-1.0	4481-4516
9	S 14-59.8 E 55-00.1	S 14-55.8 E 54-59.4	100201	8:25	9:59	IKMT	0.5	Obl.	1738	0-523	1.0-0.5	2.7-1.5	4266-4543
10	S 16-00.2 E 54-59.8	S 16-58.7 E 54-57.0	100202	15:20	16:40	IKMT	0.5	Obl.	1433	0-560	1.0-0.5	2.5-2.0	4617
11	S 17-00.3 E 54-59.9	S 17-04.7 E 54-59.9	100201	20:59	22:37	IKMT	0.5	Step	639	0-160	1.0-0.3	2.6-1.9	4218-4922
12	S 18-00.2 E 55-00.1	S 17-58.6 E 55-02.8	100202	2:32	4:06	IKMT	0.5	Step	680	0-155	1.0-0.3	2.5-2.0	4586-4590
13	S 17-59.8 E 55-59.4	S 17-56.9 E 56-00.3	100202	9:08	10:29	IKMT	0.5	Obl.	1500	-	1.0-0.5	2.3-1.5	4555-4574
14	S 16-59.8 E 56-00.1	S 16-56.3 E 56-00.4	100202	15:09	16:41	IKMT	0.5	Obl.	1500	-	1.0-0.5	2.5-2.0	4444-4499
15	S 15-59.9 E 55-59.4	S 15-56.6 E 55-59.4	100202	21:28	23:00	IKMT	0.5	Step	474	0-154	1.0-0.3	2.6-1.5	4365-4537
16	S 14-59.7 E 56-00.0	S 14-56.3 E 55-59.6	100203	3:03	4:30	IKMT	0.5	Step	550	0-158	1.0-0.3	2.5-2.0	4210-4335
17	S 14-00.3 E 56-00.1	S 13-57.7 E 56-00.5	100203	9:56	11:11	IKMT	0.5	Obl.	1440	0-599	1.0-0.5	2.5-1.5	4400-4425
18	S 13-00.3 E 55-59.5	S 12-59.7 E 55-57.1	100203	16:06	17:14	IKMT	0.5	Obl.	1275	0-503	1.0-0.5	2.5-2.0	4334-4357
19	S 13-00.1 E 57-00.1	S 13-02.4 E 57-02.9	100203	21:33	23:14	IKMT	0.5	Step	574	0-153	1.0-0.3	2.6-2.0	4343-4350
20	S 13-59.9 E 56-59.9	S 13-57.5 E 56-58.1	100204	3:20	4:45	IKMT	0.5	Step	505	0-155	1.0-0.3	2.5-1.5	4315-4323
21	S 15-00.4 E 56-59.9	S 14-58.0 E 56-57.7	100204	10:12	11:34	IKMT	0.5	Obl.	1534	0-545	1.0-0.5	2.6-1.5	4313-4334

KH-09-5 Net Record Leg 5

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Sea
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	Depth (m)
22	S 16-00.6 E 56-59.8	S 15-58.4 E 56-58.0	100204	16:49	18:04	IKMT	0.5	Obl.	1345	0-500	1.0-0.5	2.6-1.3	4332-4345
23	S 17-00.0 E 57-00.0	S 16-56.7 E 56-58.6	100204	22:27	23:55	IKMT	0.5	Step	461	0-153	1.0-0.3	2.7-1.1	3462-4247
24	S 18-00.0 E 56-59.8	S 17-57.9 E 56-58.0	100205	4:31	5:37	IKMT	0.5	Obl.	1205	0-503	1.0-0.5	2.5-1.3	4190
25	S 17-59.6 E 57-59.7	S 17-55.4 E 57-59.0	100205	10:57	12:25	IKMT	0.5	Obl.	1718	0-507	1.0-0.5	2.5-2.1	3986-4032
26	S 17-00.1 E 58-00.0	S 16-58.7 E 57-57.3	100205	17:05	18:23	IKMT	0.5	Obl.	1500	-	1.0-0.5	2.0-1.5	3493-3591
27	S 16-00.3 E 58-00.5	S 15-58.3 E 57-59.5	100205	23:29	0:51	IKMT	0.5	Step	288	0-151	1.0-0.3	2.6-2.0	4075-4088
28	S 14-59.6 E 57-59.8	S 14-56.6 E 57-58.6	100206	5:43	7:02	IKMT	0.5	Obl.	1541	0-534	1.0-0.5	2.3-1.2	4165-4186
29	S 13-59.9 E 58-00.2	S 13-58.3 E 57-58.6	100206	11:36	12:42	IKMT	0.5	Obl.	1289	0-507	1.0-0.5	2.9-2.0	4142-4166
30	S 13-00.1 E 57-59.6	S 13-00.9 E 57-56.3	100206	17:28	18:54	IKMT	0.5	Obl.	1706	0-578	1.0-0.5	2.3-1.5	4282-4285
31	S 12-59.9 E 58-59.8	S 13-01.5 E 59-00.7	100206	23:25	0:44	IKMT	0.5	Step	378	0-162	1.0-0.3	2.9-2.3	4019-4022
32	S 13-00.2 E 60-00.0	S 13-03.2 E 60-01.0	100207	5:03	6:20	IKMT	0.5	Obl.	1500	-	1.0-0.5	2.3-1.6	3620-3682
33	S 12-59.0 E 61-29.7	S 12-57.1 E 61-31.2	100207	13:23	14:44	IKMT	0.5	obl.	1500	-	1.0-0.5	2.0-2.5	2748-2852
34	S 14-00.2 E 59-50.0	S 14-03.8 E 59-51-8	100207	22:36	00:10	IKMT	0.5	Step	524	0-156	1.0-0.5	2.1-2.7	3924-3925
35	S 13-59.9 E 58-59.9	S 14-02.7 E 59-02.1	100208	03:59	05:26	IKMT	0.5	Step	620	0-156	1.0	1.5-2.5	4008-4021
36	S 15-00.4 E 59-50.0	S 15-03.2 E 59-51.1	100208	14:25	15:44	IKMT	0.5	Obl.		0-557	0.5-1.0	1.9-2.0	707-1053
37	S 15-00.1 E 58-59.9	S 15-00.8 E 59-01.8	100208	19:19	20:25	IKMT	0.5	Obl.	1189	0-503	1.0	1.5-2.5	3942-3949
38	S 16-00.5 E 58-59.6	S 16-01.8 E 59-02.2	100209	1:18	2:45	IKMT	0.5	Step	520	0-163	0.3-1.0	2.0-2.5	1792-2126
39	S 17-00.1 E 58-59.2	S 17-00.0 E 59-01.7	100209	6:48	7:58	IKMT	0.5	Obl.	1342	0-501	0.5-1.0	1.5-2.5	1076-1512
40	S 18-00.0 E 58-59.4	S 18-02.6 E 59-00.5	100209	12:58	14:24	IKMT	0.5	Obl.	1583	0-510	0.5-1.0	2.0-2.5	2470-2587

KH-09-5 Net Record Leg 6

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Sea
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	Depth (m)
1	S 17-10.2 E 71-57.4	S 17-12.6 E 71-57.0	100217	1:15	2:42	IKMT	0.5	Step	469	0-153		1.8-2.4	4546-4864
2	S 16-22.1 E 76-09.1	S 16-24.6 E 76-08.7	100217	20:08	21:36	IKMT	0.5	Step	486	0-161		1.7-2.7	4782-5007
3	S 16-13.5 E 76-57.7	S 16-16.6 E 76-56.1	100218	2:19	3:47	IKMT	0.5	Step	450	0-152		0.9-2.5	4738-4873
4	S 15-28.9 E 80-55.5	S 15-31.7 E 80-53.9	100218	20:16	21:46	IKMT	0.5	Step	491	0-160		2.0-2.6	4948-5116
5	S 15-17.5 E 81-57.1	S 15-20.6 E 81-55.3	100219	2:16	3:41	IKMT	0.5	Step	478	0-152	0.3-1.0	2.3-2.5	4823-5185
6	S 14-30.4 E 86-06.1	S 14-32.4 E 86-04.9	100219	20:06	21:27	IKMT	0.5	Step	337	0-149		1.7-2.7	2549-2683
7	S 14-17.3 E 87-15.7	S 14-18.5 E 87-17.0	100220	2:14	3:36	IKMT	0.5	Step	377	0-153	0.3-1.0	2.0-2.5	2564-2633
8	S 13-33.3 E 91-11.2	S 13-31.0 E 91-09.2	100220	20:22	21:46	IKMT	0.5	Step	434	0-150		1.7-2.7	4918-5266
9	S 13-21.8 E 92-17.0	S 13-21.0 E 92-14.6	100221	2:14	3:38	IKMT	0.5	Step	399	0-150	0.3-1.0	2.3-2.5	4822-5122
10	S 12-08.2 E 102-31.4	S 12-11.0 E 102-32.2	100222	19:31	20:58	IKMT	0.5	Step	460	0-159	0.2	1.6-2.7	3267-4531
11-H	S 11-20.1 E 109-07.8	S 11-21.1 E 109-07.9	100224	0:16	0:52	IKMT	0.5	Hori.	191	0-40	0.2	2.3-2.6	5197-5201
11-S	S 11-21.4 E 109-07.9	S 11-23.6 E 109-08.5	100224	1:06	2:30	IKMT	0.5	Step	462	0-150	0.3-0.5	1.9-2.8	5027-5162
12-H1	S 11-37.9 E 109-13.4	S 11-38.8 E 109-12.6	100224	3:54	4:26	IKMT	0.5	Hori.	127	0-17.9		1.3-2.5	4910-4918
12-H2	S 11-39.1 E 109-12.4	S 11-40.3 E 109-11.2	100224	4:37	5:18	IKMT	0.5	Hori.	173	0-27.4		1.4-2.8	4890-4902
12-H3	S 11-40.5 E 109-10.9	S 11-41.6 E 109-10.0	100224	5:30	6:02	IKMT	0.5	Hori.	169	0-27.8		1.5-2.5	4224-4930

KH-09-5_Leg5	St.1	Depth	4772 m
Date:	2010.1.30	Lat.	18 00.04S
Time:	2:13	Long.	54 01.88E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
5	29.015	35.060	4.31	0.02
10	29.019	35.060	4.32	0.02
20	28.980	35.056	4.33	0.02
30	28.728	35.045	4.41	0.02
40	27.240	34.987	4.66	0.03
50	26.645	34.959	4.70	0.03
75	25.092	34.892	4.68	0.07
100	24.171	34.856	4.61	0.14
125	23.439	34.982	4.28	0.17
150	22.351	35.185	3.81	0.10
175	21.103	35.353	3.56	0.04
200	19.909	35.315	3.13	0.03
250	17.219	35.347	3.10	0.02
300	15.439	35.327	3.38	0.02
400	12.803	35.192	4.68	0.01
500	10.751	34.912	4.87	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
Sur.	0	***	28.8	***	***	***
1	198	199	20.001	35.316	3.15	0.03
2	198	199	20.024	35.316	3.14	0.03
3	197	199	20.031	35.318	3.15	0.03
4	110	111	23.716	34.918	4.42	0.18
5	110	111	23.904	34.867	4.50	0.19
6	110	111	23.885	34.873	4.46	0.20
7	109	110	23.821	34.892	4.46	0.19
8	110	110	23.835	34.887	4.49	0.19
9	110	111	23.836	34.886	4.47	0.20
10	111	111	23.867	34.876	4.49	0.19
11	100	101	24.098	34.863	4.54	0.16
12	99	100	24.148	34.862	4.58	0.15
13	99	100	24.171	34.862	4.58	0.15
14	100	101	24.267	34.868	4.62	0.15
15	100	100	24.312	34.860	4.64	0.13
16	100	100	24.305	34.861	4.65	0.12
17	49	49	26.791	34.966	4.70	0.04
18	49	50	26.870	34.970	4.68	0.04
19	49	50	26.803	34.967	4.69	0.03
20	49	49	26.879	34.972	4.68	0.03
21	49	49	26.859	34.971	4.68	0.03
22	49	49	26.848	34.972	4.68	0.04
23	5	5	29.022	35.060	4.32	0.02
24	5	5	29.033	35.062	4.32	0.02

KH-09-5_Leg5	St.2	Depth	4702 m
Date:	2010.1.30	Lat.	17 00.02S
Time:	9:02	Long.	54 02.08E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
5	29.545	35.052	4.31	0.01
10	29.410	35.046	4.31	0.01
20	29.285	35.041	4.31	0.01
30	28.867	35.066	4.47	0.02
40	27.959	35.071	4.59	0.02
50	26.962	34.983	4.70	0.03
75	25.424	34.880	4.80	0.05
100	24.150	34.876	4.62	0.11
125	23.318	35.009	4.42	0.24
150	22.518	35.216	4.24	0.11
175	21.443	35.475	4.09	0.05
200	20.540	35.586	4.09	0.03
250	18.111	35.432	3.33	0.02
300	16.147	35.427	3.66	0.02
400	12.532	35.147	4.45	0.01
500	10.243	34.837	5.00	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
Sur.	0	***	29.8	***	***	***
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KH-09-5_Leg5	St.3	Depth	4567 m		
Date:	2010.1.30	Lat.	15 59.89S		
Time:	15:17	Long.	54 02.10E		
CTD data (LAY)	Pres.	Temp.	Sal	DO	FLC
	db	℃	(psu)	ml・l⁻¹	μg/l
	5	29.544	35.085	4.32	0.02
	10	29.561	35.085	4.32	0.02
	20	29.473	35.088	4.32	0.02
	30	29.340	35.082	4.37	0.02
	40	28.591	35.055	4.54	0.03
	50	27.694	35.019	4.62	0.04
	75	26.067	35.036	4.62	0.10
	100	25.003	34.949	4.51	0.25
	125	24.262	34.943	4.24	0.20
	150	21.999	34.983	3.04	0.08
	175	19.272	35.131	2.53	0.04
	200	18.090	35.299	2.84	0.02
	250	15.748	35.283	3.10	0.02
	300	14.167	35.303	4.07	0.01
	400	11.840	35.058	4.53	0.02
	500	10.115	34.830	4.54	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml・l⁻¹	FLC μg/l
Sur.	0	***	30.0	***	***	***
1	199	200	17.780	35.303	2.87	0.02
2	199	200	17.845	35.299	2.86	0.02
3	199	200	17.972	35.293	2.86	0.02
4	99	99	24.922	34.944	4.49	0.23
5	99	100	25.029	34.950	4.51	0.24
6	98	99	25.014	34.949	4.50	0.25
7	98	99	25.031	34.950	4.51	0.24
8	99	99	25.036	34.950	4.51	0.24
9	99	100	25.007	34.948	4.51	0.25
10	99	100	25.004	34.949	4.50	0.25
11	75	75	25.997	35.031	4.62	0.13
12	75	75	26.055	35.034	4.62	0.12
13	74	75	25.996	35.032	4.61	0.11
14	5	5	29.982	35.094	4.30	0.02
15	75	75	26.019	35.030	4.62	0.12
16	75	76	26.031	35.035	4.62	0.12
17	49	49	27.029	35.001	4.64	0.06
18	49	50	27.078	34.999	4.64	0.05
19	50	50	27.108	34.998	4.64	0.05
20	49	49	27.139	34.996	4.64	0.05
21	50	50	27.119	34.998	4.65	0.05
22	49	50	27.100	34.999	4.64	0.05
23	5	5	29.999	35.095	4.30	0.02
24	5	5	29.992	35.096	4.29	0.02

KH-09-5_Leg5	St.4	Depth	4568 m		
Date:	2010.1.30	Lat.	14 59.81S		
Time:	21:34	Long.	54 01.97E		
CTD data (LAY)	Pres.	Temp.	Sal	DO	FLC
	db	℃	(psu)	ml・l⁻¹	μg/l
	5	29.716	35.053	4.31	0.02
	10	29.660	35.060	4.31	0.02
	20	28.654	35.103	4.49	0.03
	30	27.614	35.009	4.62	0.04
	40	26.910	34.975	4.71	0.05
	50	26.198	34.945	4.74	0.06
	75	24.852	34.926	4.56	0.23
	100	23.513	34.924	4.35	0.20
	125	21.957	35.167	3.37	0.12
	150	18.949	35.070	2.29	0.06
	175	17.624	35.096	2.20	0.03
	200	16.683	35.161	2.35	0.03
	250	15.467	35.277	3.14	0.02
	300	13.374	35.090	2.96	0.02
	400	11.459	35.006	4.63	0.01
	500	9.424	34.746	4.65	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml・l⁻¹	FLC μg/l
Sur.	0	***	30.0	***	***	***
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KH-09-5_Leg5	St.5	Depth	4219 m
Date:	2010.1.31	Lat.	14 00.20S
Time:	3:56	Long.	54 02.32E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
5	29.085	35.042	4.34	0.03
10	29.088	35.041	4.35	0.03
20	29.086	35.041	4.34	0.03
30	28.842	35.050	4.42	0.03
40	27.029	35.059	4.67	0.04
50	26.345	35.022	4.70	0.05
75	24.692	34.897	4.56	0.19
100	22.944	34.959	3.85	0.19
125	21.301	35.188	3.31	0.13
150	19.060	35.108	1.99	0.08
175	17.843	35.096	1.81	0.05
200	16.096	35.078	1.98	0.03
250	14.153	35.136	2.92	0.02
300	12.724	35.074	3.23	0.02
400	10.604	34.896	3.88	0.02
500	9.590	34.809	3.40	0.02

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
Sur.	0	***	28.9	***	***	***
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KH-09-5_Leg5	St.6	Depth	4614 m
Date:	2010.1.31	Lat.	13 00.26S
Time:	10:05	Long.	54 02.24E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
10	28.966	34.985	4.35	0.02
20	28.931	34.980	4.34	0.02
30	28.903	34.983	4.35	0.03
40	26.681	35.022	4.69	0.04
50	25.567	34.952	4.70	0.05
75	23.267	34.930	4.08	0.24
100	20.805	34.975	2.67	0.13
125	18.506	35.034	2.27	0.07
150	16.964	35.081	2.10	0.04
175	16.608	35.280	2.86	0.02
200	15.444	35.240	2.95	0.02
250	14.161	35.211	3.32	0.02
300	12.609	35.058	3.28	0.02
400	11.056	34.926	3.56	0.02
500	9.920	34.817	3.70	0.02

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
Sur.	0	***	29.0	***	***	***
1	200	201	15.284	35.276	3.21	0.02
2	200	202	15.277	35.278	3.23	0.02
3	201	203	15.270	35.281	3.24	0.02
4	74	75	23.089	34.936	4.04	0.24
5	75	75	23.377	34.926	4.23	0.24
6	74	75	23.345	34.927	4.22	0.24
7	74	75	23.369	34.928	4.23	0.24
8	74	75	23.360	34.929	4.23	0.24
9	74	75	23.373	34.930	4.24	0.24
10	74	75	23.374	34.930	4.24	0.24
11	99	100	21.338	34.975	2.94	0.14
12	100	100	21.224	34.975	2.91	0.15
13	100	100	21.229	34.976	2.81	0.14
14	100	101	21.181	34.979	2.74	0.14
15	100	101	21.061	34.978	2.75	0.13
16	100	101	20.932	34.977	2.78	0.14
17	49	50	25.664	34.944	4.67	0.05
18	49	50	25.573	34.951	4.67	0.05
19	49	50	25.592	34.949	4.68	0.05
20	49	50	25.691	34.958	4.69	0.05
21	49	49	25.657	34.955	4.70	0.06
22	49	50	25.717	34.956	4.69	0.05
23	5	5	28.962	34.984	4.35	0.02
24	5	5	28.966	34.985	4.34	0.02

KH-09-5_Leg5	St.10	Depth	4620 m
Date:	2010.2.1	Lat.	16 00.01S
Time:	10:32	Long.	55 00.09E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.648	34.920	4.30	0.02
10	29.640	34.920	4.32	0.02
20	28.449	35.018	4.51	0.02
30	26.192	34.919	4.75	0.03
40	25.392	34.875	4.80	0.04
50	24.974	34.857	4.80	0.04
75	23.895	34.916	4.67	0.10
100	22.860	35.129	4.34	0.20
125	21.709	35.265	3.82	0.11
150	20.341	35.296	3.19	0.05
175	19.064	35.388	3.24	0.03
200	18.142	35.446	3.38	0.02
250	15.179	35.128	2.48	0.02
300	14.204	35.218	3.36	0.02
400	11.397	34.968	3.60	0.02
500	9.882	34.806	4.33	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	29.7	***	***	***
1	199	201	17.731	35.371	3.20	0.02
2	200	201	17.823	35.383	3.19	0.02
3	200	202	17.722	35.363	3.22	0.02
4	89	89	23.499	34.969	4.52	0.23
5	89	89	23.569	34.964	4.61	0.20
6	89	89	23.461	34.981	4.56	0.19
7	89	89	23.473	34.980	4.54	0.19
8	89	89	23.484	34.979	4.54	0.20
9	88	89	23.551	34.964	4.59	0.19
10	89	89	23.578	34.960	4.57	0.19
11	99	100	22.974	35.100	4.36	0.20
12	99	100	22.948	35.107	4.36	0.21
13	100	100	22.975	35.105	4.37	0.21
14	100	101	22.974	35.107	4.37	0.21
15	99	100	22.967	35.103	4.38	0.21
16	99	100	22.972	35.103	4.38	0.21
17	50	50	24.465	34.866	4.76	0.05
18	50	51	24.784	34.859	4.77	0.05
19	50	50	24.768	34.859	4.79	0.05
20	50	51	24.788	34.861	4.77	0.05
21	50	50	24.760	34.863	4.78	0.05
22	50	50	24.781	34.863	4.78	0.05
23	5	5	29.577	34.909	4.31	0.02
24	6	6	29.597	34.911	4.30	0.02

KH-09-5_Leg5	St.13	Depth	4351 m
Date:	2010.2.2	Lat.	18 00.03S
Time:	4:13	Long.	55 59.90E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.001	35.012	4.35	0.02
10	28.489	34.987	4.38	0.02
20	28.278	35.004	4.41	0.02
30	27.982	35.066	4.46	0.02
40	26.988	35.061	4.60	0.03
50	25.956	35.013	4.69	0.04
75	24.286	34.968	4.76	0.06
100	23.368	35.089	4.70	0.18
125	22.761	35.090	4.52	0.19
150	22.307	35.257	4.36	0.10
175	21.782	35.375	4.14	0.06
200	21.197	35.451	3.94	0.03
250	19.237	35.551	3.65	0.02
300	17.232	35.446	3.51	0.02
400	13.352	35.211	4.13	0.01
500	10.601	34.891	4.55	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	29.8	***	***	***
1	200	202	21.162	35.450	3.93	0.03
2	200	202	21.153	35.452	3.92	0.03
3	201	202	21.172	35.450	3.92	0.03
4	109	110	23.096	35.087	4.60	0.20
5	109	110	23.111	35.089	4.61	0.20
6	109	110	23.102	35.090	4.61	0.20
7	109	110	23.105	35.091	4.61	0.20
8	110	110	23.120	35.092	4.62	0.21
9	110	111	23.115	35.092	4.61	0.20
10	109	110	23.179	35.103	4.64	0.20
11	99	100	23.479	35.035	4.70	0.14
12	99	100	23.470	35.025	4.70	0.14
13	100	100	23.483	35.034	4.70	0.14
14	100	100	23.486	35.036	4.69	0.14
15	100	100	23.480	35.032	4.69	0.14
16	99	100	23.458	35.018	4.69	0.14
17	49	50	25.873	35.008	4.70	0.04
18	50	50	25.990	35.013	4.69	0.04
19	50	50	26.043	35.017	4.68	0.04
20	50	50	26.313	35.035	4.65	0.04
21	50	50	26.327	35.039	4.67	0.04
22	50	50	26.349	35.045	4.66	0.03
23	5	5	28.478	34.989	4.37	0.02
24	6	6	28.484	34.989	4.37	0.02

KH-09-5_Leg5	St.14	Depth	4493 m
Date:	2010.2.2	Lat.	16 59.93S
Time:	10:30	Long.	56 00.11E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l^{-1}	μg/l
5	29.765	35.089	4.31	0.01
10	29.471	35.082	4.32	0.01
20	29.098	35.055	4.35	0.02
30	28.741	35.064	4.40	0.02
40	28.101	35.092	4.50	0.03
50	27.269	35.080	4.56	0.04
75	25.256	34.987	4.64	0.16
100	24.158	34.965	4.60	0.26
125	22.379	35.069	3.53	0.16
150	20.391	35.109	2.65	0.07
175	19.506	35.335	3.08	0.03
200	18.321	35.538	3.59	0.02
250	16.190	35.572	4.32	0.01
300	14.240	35.387	4.64	0.01
400	11.994	35.093	4.91	0.01
500	10.488	34.872	5.06	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	30.0	***	***	***
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KH-09-5_Leg5	St.15	Depth	4081 m
Date:	2010.2.2	Lat.	16 00.14S
Time:	16:27	Long.	55 59.87E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l^{-1}	μg/l
5	29.670	34.935	4.33	0.02
10	29.497	34.933	4.34	0.02
20	28.828	34.977	4.42	0.02
30	28.264	35.056	4.56	0.03
40	26.694	35.033	4.64	0.03
50	26.183	34.994	4.67	0.04
75	24.979	34.920	4.75	0.05
100	23.623	34.965	4.64	0.18
125	22.989	35.069	4.41	0.25
150	21.666	35.278	3.73	0.11
175	19.918	35.390	3.32	0.03
200	18.333	35.360	3.09	0.02
250	15.970	35.418	3.70	0.02
300	13.851	35.221	3.67	0.02
400	10.890	34.931	4.51	0.01
500	9.443	34.751	4.44	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	29.9	***	***	***
1	199	200	18.447	35.367	3.11	0.02
2	199	200	18.462	35.368	3.10	0.02
3	199	201	18.442	35.367	3.12	0.02
4	105	105	23.375	35.007	4.52	0.26
5	105	105	23.373	35.009	4.52	0.26
6	104	105	23.378	35.008	4.53	0.25
7	104	105	23.397	35.004	4.55	0.26
8	104	105	23.401	35.004	4.53	0.27
9	105	105	23.380	35.009	4.53	0.26
10	104	105	23.407	35.003	4.53	0.26
11	100	100	23.606	34.965	4.63	0.23
12	99	100	23.618	34.965	4.63	0.21
13	99	100	23.616	34.965	4.64	0.22
14	100	100	23.613	34.965	4.63	0.21
15	99	100	23.617	34.965	4.64	0.21
16	100	100	23.612	34.965	4.64	0.21
17	51	51	26.245	34.997	4.67	0.03
18	50	51	26.229	34.996	4.67	0.03
19	50	51	26.254	34.998	4.67	0.04
20	50	51	26.249	34.999	4.67	0.03
21	50	51	26.242	34.998	4.67	0.04
22	51	51	26.247	34.998	4.66	0.04
23	4	4	29.609	34.930	4.33	0.02
24	5	5	29.610	34.932	4.33	0.02

KH-09-5_Leg5	St.16	Depth	4175 m
Date:	2010.2.3	Lat.	14 55.97S
Time:	0:45	Long.	55 59.49E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.953	35.023	4.28	0.02
10	29.759	35.020	4.29	0.02
20	29.488	35.024	4.33	0.02
30	27.802	35.009	4.63	0.03
40	26.463	34.953	4.75	0.04
50	25.711	34.920	4.76	0.04
75	23.987	34.908	4.48	0.25
100	23.099	35.020	4.15	0.23
125	21.988	35.184	3.66	0.15
150	21.318	35.279	3.47	0.10
175	20.205	35.364	3.29	0.04
200	18.985	35.407	3.25	0.02
250	15.595	35.095	2.22	0.02
300	14.528	35.286	3.63	0.02
400	11.960	35.069	4.56	0.01
500	9.871	34.794	4.65	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	30.0	***	***	***
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KH-09-5_Leg5	St.17	Depth	4399 m
Date:	2010.2.3	Lat.	14 00.23S
Time:	5:13	Long.	56 00.06E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.195	34.708	4.32	0.02
10	29.191	34.709	4.32	0.02
20	29.156	34.718	4.33	0.02
30	28.975	34.936	4.35	0.02
40	27.960	35.080	4.51	0.03
50	26.467	35.064	4.65	0.04
75	24.770	34.941	4.61	0.11
100	23.274	34.978	4.42	0.24
125	22.255	35.144	3.98	0.10
150	20.545	35.087	2.92	0.06
175	18.412	35.119	2.36	0.03
200	16.999	35.118	2.14	0.03
250	15.296	35.209	2.85	0.02
300	13.267	35.094	3.01	0.02
400	10.896	34.932	4.38	0.01
500	9.461	34.777	3.82	0.02

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	29.4	***	***	***
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KH-09-5_Leg5	St.18	Depth	4329 m
Date:	2010.2.3	Lat.	13 00.01S
Time:	11:21	Long.	55 59.93E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l^{-1}	μg/l
5	29.050	34.947	4.34	0.02
10	29.001	34.944	4.33	0.02
20	28.844	34.938	4.34	0.02
30	28.432	34.984	4.48	0.03
40	26.910	35.060	4.62	0.05
50	25.975	35.063	4.70	0.08
75	22.887	35.100	3.82	0.26
100	21.239	35.243	3.49	0.13
125	19.907	35.344	3.23	0.07
150	18.185	35.443	3.30	0.03
175	16.594	35.334	3.09	0.02
200	15.437	35.295	3.23	0.02
250	13.674	35.110	2.92	0.02
300	12.445	34.980	2.72	0.02
400	10.778	34.872	3.06	0.02
500	9.568	34.788	3.33	0.02

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	29.2	***	***	***
1	198	199	15.351	35.296	3.26	0.02
2	199	200	15.387	35.300	3.26	0.02
3	199	200	15.382	35.302	3.27	0.02
4	75	75	22.077	35.132	3.65	0.22
5	74	75	22.507	35.111	3.68	0.23
6	74	74	22.584	35.103	3.72	0.24
7	74	74	22.597	35.113	3.72	0.25
8	73	74	22.578	35.116	3.75	0.25
9	74	74	22.622	35.114	3.74	0.25
10	74	75	22.540	35.126	3.74	0.26
11	101	101	21.070	35.257	3.46	0.11
12	101	102	21.054	35.262	3.45	0.12
13	101	101	21.048	35.265	3.43	0.11
14	100	101	21.040	35.267	3.45	0.12
15	101	102	21.035	35.265	3.43	0.12
16	102	102	21.029	35.265	3.44	0.12
17	49	50	25.153	35.023	4.69	0.15
18	50	50	25.457	35.033	4.68	0.09
19	50	50	25.442	35.035	4.68	0.09
20	49	50	25.429	35.037	4.69	0.09
21	50	50	25.434	35.037	4.69	0.09
22	50	50	25.422	35.035	4.68	0.09
23	5	5	29.042	34.944	4.33	0.02
24	5	5	29.042	34.945	4.33	0.02

KH-09-5_Leg5	St.21	Depth	4312 m
Date:	2010.2.4	Lat.	15 00.29S
Time:	5:15	Long.	56 59.94E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l^{-1}	μg/l
5	29.641	35.010	4.29	0.02
10	29.597	35.005	4.31	0.02
20	28.341	35.094	4.50	0.02
30	27.913	35.106	4.58	0.02
40	27.157	35.086	4.64	0.03
50	26.370	35.030	4.67	0.04
75	24.392	34.929	4.65	0.12
100	22.859	35.018	4.04	0.20
125	21.780	35.111	3.45	0.14
150	20.098	35.201	2.99	0.08
175	18.657	35.341	3.03	0.03
200	16.990	35.311	2.98	0.02
250	15.741	35.459	4.03	0.02
300	13.709	35.270	4.18	0.02
400	11.263	34.983	4.70	0.01
500	9.402	34.744	4.62	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	29.7	***	***	***
1	89	90	23.093	34.992	4.13	0.21
2	89	90	23.132	34.989	4.16	0.22
3	89	89	23.180	34.987	4.19	0.22
4	90	90	23.236	34.985	4.22	0.22
5	89	90	23.281	34.983	4.23	0.22
6	89	90	23.288	34.983	4.25	0.22
7	90	90	23.281	34.984	4.24	0.22
8	89	90	23.352	34.979	4.27	0.22
9	89	90	23.390	34.977	4.28	0.22
10	89	90	23.407	34.976	4.27	0.22
11	89	90	23.411	34.977	4.28	0.22
12	89	90	23.417	34.976	4.29	0.23
13	90	90	23.413	34.977	4.28	0.22
14	89	90	23.409	34.977	4.28	0.22
15	100	100	22.681	35.031	3.90	0.19
16	100	100	22.661	35.034	3.89	0.20
17	89	90	23.410	34.977	4.27	0.23
18	90	90	23.381	34.978	4.28	0.23
19	90	90	23.378	34.978	4.27	0.23
20	89	90	23.377	34.978	4.28	0.22
21	49	49	26.040	35.009	4.69	0.05
22	49	50	26.063	35.012	4.68	0.04
23	5	5	29.672	35.011	4.29	0.01
24	5	5	29.674	35.012	4.30	0.01

KH-09-5_Leg5	St.22	Depth	4343 m
Date:	2010.2.4	Lat.	16 00.25S
Time:	11:59	Long.	56 59.99E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l^{-1}	μg/l
5	29.600	34.999	4.31	0.02
10	29.022	35.026	4.35	0.02
20	28.563	35.088	4.44	0.02
30	27.503	35.115	4.58	0.03
40	26.345	35.055	4.65	0.05
50	25.812	35.088	4.59	0.09
75	24.174	35.025	4.29	0.27
100	22.682	35.108	3.81	0.21
125	21.462	35.210	3.45	0.11
150	20.581	35.346	3.44	0.05
175	19.073	35.432	3.38	0.02
200	17.016	35.185	2.47	0.03
250	15.933	35.366	3.50	0.02
300	13.828	35.272	4.04	0.01
400	11.833	35.056	4.59	0.01
500	10.180	34.838	4.62	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	29.8	***	***	***
1	74	75	24.474	34.981	4.39	0.26
2	74	75	24.515	34.977	4.49	0.27
3	74	75	24.509	34.983	4.50	0.26
4	75	75	24.548	34.982	4.49	0.28
5	75	75	24.556	34.974	4.49	0.26
6	75	75	24.595	34.976	4.50	0.26
7	74	75	24.613	34.985	4.51	0.26
8	75	75	24.607	34.977	4.54	0.25
9	74	75	24.645	34.987	4.53	0.25
10	75	75	24.665	34.975	4.53	0.26
11	74	75	24.705	34.976	4.55	0.25
12	75	75	24.681	34.977	4.54	0.26
13	74	74	24.694	34.984	4.55	0.25
14	74	75	24.742	34.986	4.55	0.25
15	74	75	24.728	34.984	4.55	0.25
16	74	75	24.722	34.981	4.54	0.27
17	75	75	24.668	34.981	4.53	0.26
18	75	75	24.700	34.977	4.55	0.26
19	74	75	24.708	34.977	4.56	0.25
20	74	75	24.746	34.980	4.56	0.25
21	74	75	24.690	34.975	4.56	0.27
22	74	75	24.598	34.978	4.54	0.26
23	74	75	24.571	34.974	4.55	0.26
24	74	74	24.592	34.974	4.55	0.27

KH-09-5_Leg5	St.25	Depth	3939 m
Date:	2010.2.5	Lat.	17 59.86S
Time:	5:59	Long.	58 00.02E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l^{-1}	μg/l
5	28.857	34.920	4.34	0.01
10	28.860	34.922	4.35	0.01
20	28.718	34.914	4.36	0.02
30	28.098	34.910	4.41	0.02
40	27.975	34.927	4.43	0.02
50	26.960	34.969	4.63	0.03
75	24.465	35.041	4.80	0.05
100	23.737	35.139	4.78	0.07
125	23.006	35.249	4.73	0.11
150	22.391	35.356	4.54	0.15
175	20.999	35.529	4.08	0.05
200	20.238	35.613	4.04	0.02
250	18.477	35.585	3.78	0.01
300	16.019	35.487	3.89	0.01
400	13.405	35.212	4.09	0.01
500	11.246	34.981	4.74	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	29.2	***	***	***
1	198	200	20.020	35.620	4.00	0.02
2	199	200	20.048	35.619	4.02	0.02
3	199	200	20.095	35.617	4.02	0.02
4	138	139	22.654	35.323	4.69	0.16
5	138	139	22.659	35.322	4.69	0.16
6	138	138	22.658	35.323	4.68	0.16
7	138	139	22.660	35.321	4.69	0.16
8	138	139	22.658	35.323	4.69	0.16
9	138	139	22.660	35.323	4.69	0.16
10	138	139	22.664	35.322	4.69	0.16
11	99	100	23.661	35.146	4.77	0.07
12	99	100	23.828	35.111	4.77	0.07
13	99	99	23.789	35.120	4.78	0.06
14	99	99	23.836	35.103	4.78	0.07
15	99	99	23.848	35.101	4.77	0.06
16	99	99	23.850	35.101	4.77	0.06
17	50	50	26.122	34.995	4.73	0.03
18	49	50	26.231	34.992	4.72	0.03
19	49	49	26.234	34.994	4.71	0.03
20	49	50	26.351	34.991	4.70	0.03
21	49	50	26.346	34.991	4.70	0.03
22	49	50	26.343	34.991	4.70	0.03
23	5	5	29.030	34.928	4.34	0.01
24	5	5	28.965	34.929	4.35	0.01

KH-09-5_Leg5	St.26	Depth	3524 m
Date:	2010.2.5	Lat.	17 00.06S
Time:	12:30	Long.	58 00.15E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
5	29.468	34.950	4.31	0.02
10	29.406	34.943	4.32	0.02
20	28.491	34.961	4.43	0.03
30	27.937	35.000	4.48	0.03
40	27.208	35.034	4.55	0.05
50	26.520	35.036	4.59	0.07
75	25.290	35.022	4.58	0.23
100	23.742	35.000	4.31	0.26
125	22.216	35.143	3.92	0.17
150	20.951	35.262	3.22	0.07
175	19.257	35.489	3.51	0.02
200	18.135	35.518	3.62	0.02
250	15.617	35.347	3.45	0.02
300	14.412	35.332	3.99	0.01
400	11.518	35.018	4.79	0.01
500	10.207	34.836	4.84	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
Sur.	0	***	29.3	***	***	***
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KH-09-5_Leg5	St.27	Depth	4076 m
Date:	2010.2.5	Lat.	16 00.26S
Time:	18:37	Long.	58 00.25E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
5	29.672	34.979	4.29	0.02
10	29.669	34.978	4.29	0.02
20	28.263	35.048	4.50	0.03
30	27.455	35.069	4.58	0.03
40	26.217	35.006	4.67	0.04
50	25.348	34.963	4.71	0.05
75	23.694	34.938	4.68	0.08
100	22.866	35.083	4.34	0.23
125	21.949	35.231	3.85	0.14
150	20.143	35.237	3.01	0.06
175	19.016	35.235	2.69	0.04
200	17.994	35.252	2.71	0.03
250	16.568	35.469	3.74	0.01
300	14.469	35.332	3.96	0.02
400	11.191	34.971	4.68	0.01
500	9.279	34.733	4.51	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l⁻¹	FLC μg/l
Sur.	0	***	29.6	***	***	***
1	199	200	17.962	35.249	2.71	0.02
2	199	200	17.964	35.250	2.71	0.03
3	199	200	17.960	35.251	2.71	0.03
4	99	100	22.739	35.090	4.22	0.21
5	100	100	22.679	35.100	4.23	0.21
6	100	100	22.710	35.099	4.21	0.21
7	99	100	22.622	35.108	4.23	0.21
8	100	100	22.715	35.096	4.23	0.21
9	99	100	22.698	35.100	4.24	0.21
10	99	100	22.718	35.098	4.24	0.21
11	74	75	23.587	34.950	4.66	0.09
12	75	75	23.595	34.951	4.66	0.09
13	75	75	23.594	34.950	4.66	0.09
14	74	75	23.596	34.950	4.65	0.09
15	74	75	23.594	34.951	4.67	0.09
16	75	75	23.594	34.954	4.67	0.09
17	49	49	24.776	34.916	4.73	0.05
18	49	50	24.846	34.920	4.74	0.05
19	49	49	24.836	34.921	4.73	0.05
20	49	49	24.857	34.922	4.74	0.05
21	49	49	24.857	34.921	4.74	0.05
22	50	50	24.860	34.922	4.74	0.05
23	5	5	29.683	34.965	4.29	0.02
24	5	5	29.682	34.966	4.29	0.02

KH-09-5_Leg5	St.28	Depth	4162 m
Date:	2010.2.6	Lat.	14 59.90S
Time:	1:06	Long.	58 00.05E

CTD data (LAY)	Pres.	Temp.	Sal	DO	FLC
	db	℃	(psu)	ml·l^{-1}	μg/l
	5	29.400	35.026	4.29	0.03
	10	29.399	35.025	4.29	0.02
	20	28.612	34.955	4.36	0.03
	30	27.883	35.029	4.47	0.04
	40	25.881	35.030	4.57	0.15
	50	25.472	35.044	4.45	0.23
	75	23.690	34.932	4.63	0.19
	100	22.595	35.087	4.16	0.17
	125	21.761	35.173	3.56	0.12
	150	20.494	35.363	3.42	0.05
	175	19.377	35.391	3.15	0.03
	200	18.205	35.357	3.09	0.02
	250	16.442	35.440	3.68	0.02
	300	14.490	35.300	3.89	0.02
	400	11.611	35.014	4.24	0.01
	500	9.536	34.766	4.57	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	29.2	***	***	***
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KH-09-5_Leg5	St.29	Depth	4143 m
Date:	2010.2.6	Lat.	13 59.95S
Time:	6:55	Long.	58 00.08E

CTD data (LAY)	Pres.	Temp.	Sal	DO	FLC
	db	℃	(psu)	ml·l^{-1}	μg/l
	5	29.225	34.919	4.32	0.01
	10	29.179	34.919	4.32	0.02
	20	28.808	34.934	4.39	0.02
	30	27.443	35.099	4.56	0.03
	40	26.327	35.119	4.63	0.03
	50	24.682	34.919	4.69	0.06
	75	22.972	35.024	4.57	0.21
	100	22.737	35.069	4.53	0.15
	125	21.292	35.206	3.40	0.10
	150	20.472	35.286	3.22	0.07
	175	19.328	35.454	3.37	0.04
	200	17.233	35.174	2.30	0.03
	250	14.693	35.136	2.69	0.02
	300	13.388	35.087	2.99	0.02
	400	11.538	34.987	3.72	0.02
	500	9.789	34.805	3.84	0.02

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	29.4	***	***	***
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KH-09-5_Leg5	St.30	Depth	4282 m
Date:	2010.2.6	Lat.	12 59.96S
Time:	12:49	Long.	57 59.91E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.353	34.631	4.33	0.02
10	29.248	34.630	4.34	0.02
20	29.149	34.641	4.35	0.03
30	28.416	34.703	4.50	0.04
40	26.907	34.796	4.60	0.09
50	25.709	34.855	4.55	0.27
75	22.271	35.063	3.65	0.29
100	19.543	35.064	2.51	0.14
125	18.739	35.424	3.34	0.05
150	17.465	35.430	3.27	0.03
175	15.366	35.173	2.62	0.03
200	14.621	35.163	2.73	0.02
250	13.341	35.120	3.08	0.03
300	12.202	35.045	3.41	0.02
400	10.511	34.882	3.52	0.02
500	9.393	34.757	4.00	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	29.4	***	***	***
1	199	200	14.694	35.172	2.76	0.02
2	199	200	14.687	35.172	2.76	0.02
3	199	201	14.682	35.172	2.76	0.02
4	60	60	24.923	34.884	4.31	0.28
5	60	60	24.885	34.892	4.31	0.29
6	60	60	24.920	34.890	4.32	0.37
7	60	60	24.920	34.891	4.33	0.28
8	60	60	24.907	34.892	4.32	0.28
9	60	60	24.916	34.892	4.33	0.29
10	60	60	24.912	34.893	4.33	0.28
11	100	100	19.759	35.106	2.66	0.14
12	100	100	19.809	35.119	2.67	0.14
13	100	100	19.813	35.121	2.68	0.14
14	100	100	19.804	35.119	2.68	0.14
15	99	100	19.818	35.126	2.69	0.14
16	99	100	19.820	35.125	2.72	0.13
17	49	50	26.044	34.840	4.60	0.20
18	50	50	26.032	34.840	4.60	0.20
19	49	50	26.007	34.843	4.60	0.19
20	49	50	26.056	34.841	4.61	0.33
21	50	50	26.074	34.841	4.61	0.19
22	50	50	26.072	34.841	4.61	0.19
23	5	5	29.770	34.639	4.32	0.02
24	5	5	29.764	34.639	4.32	0.03

KH-09-5_Leg5	St.33	Depth	2748 m
Date:	2010.2.7	Lat.	12 59.75S
Time:	8:33	Long.	61 29.90E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.378	34.604	4.31	0.02
10	29.294	34.614	4.33	0.02
20	29.028	34.642	4.36	0.02
30	27.846	34.704	4.55	0.03
40	25.202	34.796	4.74	0.05
50	24.476	34.825	4.74	0.07
75	23.016	34.962	4.41	0.31
100	21.702	35.276	3.93	0.14
125	20.439	35.295	3.27	0.08
150	18.181	35.160	2.57	0.04
175	17.159	35.150	2.36	0.03
200	16.905	35.357	2.99	0.02
250	15.181	35.444	4.07	0.02
300	13.530	35.295	4.58	0.01
400	11.072	34.955	4.66	0.01
500	9.283	34.722	4.45	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	29.6	***	***	***
1	199	200	16.878	35.388	3.18	0.02
2	198	200	16.920	35.377	3.06	0.02
3	198	200	16.918	35.374	3.07	0.02
4	75	75	23.644	34.871	4.63	0.19
5	75	75	23.841	34.853	4.68	0.13
6	75	75	23.795	34.854	4.68	0.13
7	75	76	23.829	34.854	4.69	0.14
8	75	76	23.839	34.853	4.67	0.14
9	75	76	23.846	34.853	4.68	0.15
10	75	75	23.845	34.853	4.67	0.14
11	100	101	21.871	35.226	4.05	0.17
12	100	101	21.981	35.189	4.14	0.20
13	101	101	22.007	35.181	4.11	0.20
14	100	101	22.054	35.163	4.13	0.21
15	99	100	22.081	35.156	4.18	0.21
16	99	99	22.161	35.137	4.19	0.22
17	50	50	25.219	34.801	4.73	0.06
18	51	51	25.086	34.806	4.74	0.06
19	50	51	25.129	34.806	4.74	0.05
20	50	50	25.205	34.804	4.74	0.06
21	50	50	25.282	34.803	4.74	0.06
22	51	51	24.862	34.814	4.74	0.06
23	6	6	29.658	34.602	4.32	0.01
24	6	6	29.663	34.603	4.32	0.02

KH-09-5_Leg5	St.35	Depth	4008 m
Date:	2010.2.8	Lat.	14 02.70S
Time:	1:41	Long.	59 02.28E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.383	34.976	4.29	0.03
10	29.379	34.976	4.30	0.03
20	28.880	34.960	4.37	0.04
30	27.957	34.999	4.58	0.04
40	26.364	34.968	4.72	0.04
50	25.859	34.952	4.70	0.05
75	24.047	34.918	4.70	0.08
100	23.178	34.993	4.53	0.18
125	21.789	35.132	3.44	0.13
150	20.750	35.404	3.60	0.07
175	19.576	35.495	3.51	0.03
200	17.642	35.329	2.91	0.02
250	15.361	35.100	2.28	0.02
300	13.654	35.072	2.69	0.02
400	11.729	35.015	3.79	0.02
500	10.194	34.836	4.92	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	29.3	***	***	***
1	198	200	17.872	35.353	2.97	0.03
2	198	200	17.846	35.354	2.97	0.02
3	199	201	17.859	35.355	2.97	0.02
4	107	107	22.196	35.098	3.69	0.16
5	107	108	22.320	35.084	3.77	0.16
6	108	108	22.418	35.076	3.78	0.15
7	107	108	22.400	35.080	3.79	0.16
8	107	108	22.465	35.077	3.83	0.16
9	107	108	22.630	35.067	3.92	0.16
10	107	108	22.723	35.062	3.93	0.16
11	98	99	23.006	35.022	4.31	0.18
12	99	100	23.140	34.998	4.51	0.19
13	99	99	23.151	34.996	4.54	0.18
14	98	99	23.136	34.999	4.52	0.18
15	99	99	23.154	34.994	4.55	0.18
16	99	99	23.179	34.990	4.55	0.18
17	49	50	25.484	34.937	4.68	0.06
18	50	50	25.406	34.936	4.68	0.05
19	49	50	25.534	34.942	4.69	0.05
20	50	50	25.634	34.942	4.70	0.05
21	50	51	25.651	34.944	4.70	0.05
22	50	50	25.587	34.944	4.70	0.05
23	5	5	29.035	34.958	4.35	0.03
24	5	5	29.072	34.960	4.34	0.03

KH-09-5_Leg5	St.38	Depth	2200 m
Date:	2010.2.8	Lat.	16 00.29S
Time:	20:30	Long.	58 59.77E

CTD data (LAY)

Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
5	29.553	34.889	4.30	0.06
10	29.550	34.889	4.30	0.06
20	28.455	34.922	4.35	0.07
30	27.404	35.028	4.47	0.10
40	26.941	35.060	4.48	0.16
50	26.026	35.083	4.40	0.27
75	25.296	35.055	4.40	0.25
100	23.903	35.084	3.85	0.22
125	21.628	35.145	3.18	0.12
150	20.522	35.327	3.25	0.08
175	17.627	35.236	2.55	0.03
200	16.730	35.270	2.79	0.02
250	15.128	35.067	2.09	0.03
300	13.770	35.037	2.39	0.02
400	12.455	35.118	4.25	0.01
500	9.992	34.814	4.62	0.01

CTD data (BTL)

BTL No.	Depth m	Pres. db	Temp. ℃	Sal (psu)	DO ml·l^{-1}	FLC μg/l
Sur.	0	***	29.6	***	***	***
1	198	200	16.663	35.234	2.56	0.02
2	199	200	16.705	35.164	2.28	0.03
3	199	200	16.685	35.147	2.34	0.03
4	74	75	24.622	35.053	4.23	0.23
5	75	75	24.733	35.005	4.46	0.22
6	75	75	24.739	35.005	4.44	0.23
7	75	75	24.741	35.006	4.44	0.23
8	74	75	24.731	35.008	4.42	0.23
9	74	75	24.744	35.006	4.45	0.23
10	75	75	24.743	35.005	4.45	0.22
11	99	100	23.673	35.079	3.58	0.17
12	99	100	23.640	35.088	3.66	0.18
13	99	100	23.646	35.084	3.77	0.19
14	99	100	23.740	35.083	3.81	0.19
15	99	100	23.750	35.084	3.81	0.19
16	99	100	23.776	35.086	3.80	0.19
17	49	50	25.526	35.082	4.37	0.24
18	49	50	25.565	35.084	4.38	0.24
19	49	49	25.563	35.085	4.37	0.25
20	50	51	25.567	35.085	4.38	0.23
21	49	50	25.570	35.085	4.38	0.26
22	49	50	25.573	35.085	4.38	0.25
23	6	6	29.495	34.895	4.30	0.06
24	6	6	29.545	34.894	4.30	0.05

KH-09-5_Leg5	St.40		Depth	2460 m	
Date:	2010.2.9		Lat.	18	00.01S
Time:	8:13		Long.	58	59.76E

CTD data (LAY)	Pres.	Temp.	Sal	DO	FLC
	db	℃	(psu)	$ml \cdot l^{-1}$	μg/l
	5	29.368	34.736	4.33	0.02
	10	29.197	34.697	4.33	0.02
	20	28.081	34.762	4.42	0.02
	30	27.867	34.877	4.46	0.02
	40	27.239	34.994	4.56	0.02
	50	26.190	35.007	4.66	0.03
	75	24.678	34.979	4.72	0.06
	100	23.337	35.016	4.68	0.13
	125	22.225	35.319	4.31	0.12
	150	21.106	35.359	3.59	0.06
	175	20.490	35.372	3.42	0.05
	200	18.588	35.349	3.05	0.03
	250	17.556	35.487	3.52	0.02
	300	16.035	35.528	4.02	0.01
	400	12.740	35.184	4.52	0.01
	500	10.635	34.894	4.91	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	$ml \cdot l^{-1}$	μg/l
Sur.	0	***	29.5	***	***	***
1	198	199	18.417	35.347	3.06	0.02
2	199	200	18.584	35.348	3.06	0.03
3	199	200	18.544	35.347	3.06	0.03
4	115	116	22.331	35.294	4.35	0.13
5	116	117	22.335	35.296	4.35	0.13
6	116	116	22.346	35.294	4.36	0.13
7	116	116	22.354	35.292	4.36	0.13
8	116	117	22.338	35.297	4.36	0.13
9	117	117	22.328	35.301	4.36	0.13
10	115	115	22.374	35.288	4.37	0.13
11	100	100	23.216	35.051	4.67	0.15
12	100	100	23.233	35.043	4.66	0.15
13	99	100	23.264	35.029	4.66	0.15
14	99	100	23.279	35.022	4.66	0.15
15	100	100	23.272	35.030	4.66	0.15
16	99	100	23.281	35.021	4.67	0.15
17	51	51	26.080	35.001	4.66	0.03
18	51	52	26.172	35.005	4.66	0.03
19	50	51	26.189	35.005	4.65	0.03
20	51	51	26.203	35.005	4.65	0.03
21	51	52	26.179	35.008	4.65	0.03
22	51	51	26.213	35.006	4.65	0.03
23	6	6	29.398	34.721	4.33	0.01
24	5	6	29.307	34.716	4.33	0.01

KH-09-5_Leg6	St.1	Depth	4853 m
Date:	2010.2.16	Lat.	17 10.17S
Time:	19:26	Long.	71 55.71E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l⁻¹	μg/l
10	28.820	34.392	4.33	0.01
20	28.822	34.392	4.34	0.02
30	28.822	34.394	4.33	0.02
40	28.721	34.402	4.35	0.02
50	27.412	34.602	4.56	0.03
75	25.339	34.729	4.66	0.06
100	22.676	35.021	4.11	0.34
125	21.315	35.113	3.30	0.15
150	20.889	35.267	3.61	0.07
175	20.112	35.494	3.63	0.03
200	19.723	35.623	3.84	0.02
250	18.167	35.691	3.99	0.01
300	16.382	35.623	4.23	0.01
400	12.602	35.182	4.79	0.01
500	10.555	34.883	5.03	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l⁻¹	μg/l
Sur.	0	***	28.8	***	***	***
1	198	200	19.695	35.626	3.86	0.02
2	199	200	19.694	35.627	3.86	0.02
3	199	200	19.7	35.628	3.85	0.02
4	199	200	19.693	35.628	3.85	0.02
5	199	200	19.694	35.628	3.86	0.02
6	99	100	22.360	35.072	4.03	0.25
7	99	99	22.326	35.071	4.04	0.28
8	100	100	22.423	35.060	4.05	0.29
9	100	100	22.496	35.050	4.09	0.29
10	99	100	22.541	35.039	4.16	0.30
11	74	74	24.333	34.856	4.63	0.12
12	75	75	24.635	34.832	4.64	0.10
13	75	76	24.736	34.818	4.65	0.10
14	75	75	24.855	34.797	4.66	0.09
15	74	74	24.983	34.779	4.66	0.08
16	50	50	26.823	34.579	4.62	0.04
17	50	50	27.126	34.584	4.60	0.04
18	49	50	27.149	34.592	4.59	0.03
19	49	50	27.326	34.601	4.57	0.03
20	49	49	27.450	34.607	4.56	0.03
21	4	4	28.809	34.391	4.34	0.02
22	4	4	28.809	34.391	4.33	0.02
23	4	4	28.807	34.391	4.33	0.02
24	4	4	28.808	34.391	4.34	0.02

KH-09-5_Leg6	St.2	Depth	4807 m
Date:	2010.2.17	Lat.	16 22.30S
Time:	14:27	Long.	76 09.48E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l⁻¹	μg/l
5	28.875	34.202	4.32	0.02
10	28.882	34.202	4.32	0.03
20	28.885	34.202	4.32	0.02
30	28.837	34.206	4.33	0.03
40	28.698	34.228	4.37	0.04
50	28.041	34.339	4.43	0.06
75	26.975	34.838	4.18	0.18
100	23.112	34.912	3.75	0.25
125	21.138	34.961	2.72	0.12
150	19.397	35.040	2.67	0.05
175	19.767	35.447	3.45	0.03
200	18.632	35.533	3.58	0.02
250	17.491	35.681	4.03	0.01
300	15.274	35.459	4.00	0.01
400	11.626	35.023	4.34	0.01
500	9.628	34.749	4.99	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l⁻¹	μg/l
Sur.	0	***	28.7	***	***	***
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KH-09-5_Leg6	St.4	Depth	5111 m
Date:	2010.2.18	Lat.	15 28.90S
Time:	13:22	Long.	80 55.26E

CTD data (LAY)	Pres.	Temp.	Sal	DO	FLC
	db	℃	(psu)	ml·l⁻¹	μg/l
	10	28.544	34.217	4.35	0.02
	20	28.533	34.210	4.36	0.02
	30	28.437	34.231	4.38	0.03
	40	28.405	34.354	4.37	0.03
	50	28.305	34.407	4.37	0.03
	75	27.711	34.716	4.48	0.05
	100	25.895	34.774	4.53	0.14
	125	22.086	34.839	2.94	0.17
	150	19.862	34.972	2.50	0.07
	175	19.336	35.324	3.15	0.04
	200	17.578	35.180	2.78	0.03
	250	15.039	35.079	2.78	0.02
	300	13.510	35.113	3.18	0.02
	400	11.248	34.969	4.25	0.01
	500	9.471	34.738	4.46	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l⁻¹	μg/l
Sur.	0	***	28.6	***	***	***
1	198	200	17.520	35.190	2.79	0.03
2	199	200	17.617	35.177	2.78	0.03
3	199	200	17.6	35.183	2.76	0.02
4	199	200	17.718	35.185	2.75	0.03
5	199	200	17.820	35.191	2.75	0.03
6	112	113	23.902	34.854	3.94	0.23
7	112	112	24.009	34.858	4.06	0.23
8	112	113	24.031	34.862	4.06	0.23
9	112	112	24.024	34.857	4.07	0.23
10	112	113	24.026	34.872	4.05	0.23
11	99	99	25.537	34.776	4.56	0.15
12	99	99	25.693	34.785	4.55	0.15
13	99	100	25.736	34.788	4.55	0.15
14	99	100	25.756	34.790	4.55	0.14
15	99	100	25.789	34.791	4.54	0.15
16	50	50	28.281	34.403	4.36	0.03
17	50	50	28.280	34.403	4.37	0.03
18	50	50	28.279	34.403	4.37	0.04
19	50	50	28.276	34.402	4.37	0.04
20	50	50	28.277	34.403	4.37	0.03
21	5	5	28.512	34.211	4.37	0.02
22	4	4	28.514	34.212	4.37	0.02
23	4	4	28.513	34.211	4.35	0.02
24	4	4	28.514	34.212	4.36	0.03

KH-09-5_Leg6	St.6	Depth	2553 m
Date:	2010.2.19	Lat.	14 30.36S
Time:	13:22	Long.	86 05.99E

CTD data (LAY)	Pres.	Temp.	Sal	DO	FLC
	db	℃	(psu)	ml·l⁻¹	μg/l
	10	28.447	34.333	4.36	0.03
	20	28.437	34.332	4.36	0.03
	30	28.373	34.339	4.37	0.03
	40	28.333	34.362	4.38	0.04
	50	28.200	34.404	4.41	0.05
	75	26.645	34.669	4.41	0.12
	100	25.267	34.676	4.30	0.29
	125	22.209	34.779	3.15	0.13
	150	19.879	34.751	2.48	0.06
	175	19.236	35.273	3.11	0.02
	200	17.399	35.085	2.74	0.02
	250	15.932	35.241	3.10	0.02
	300	14.020	35.195	3.38	0.02
	400	11.208	34.955	4.17	0.01
	500	9.178	34.713	3.09	0.02

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l⁻¹	μg/l
Sur.	0	***	28.5	***	***	***
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KH-09-5_Leg6	St.8	Depth	5217 m
Date:	2010.2.20	Lat.	13 33.03S
Time:	12:24	Long.	91 11.24E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml・l^{-1}	μg/l
10	28.981	34.064	4.33	0.03
20	28.866	34.169	4.36	0.03
30	27.956	34.365	4.48	0.04
40	27.545	34.528	4.50	0.05
50	27.112	34.513	4.50	0.06
75	25.788	34.677	4.50	0.14
100	23.503	34.881	3.93	0.22
125	21.952	35.015	3.65	0.10
150	20.131	34.996	3.09	0.05
175	17.957	34.947	2.71	0.02
200	16.672	34.937	2.65	0.02
250	14.804	35.069	2.98	0.02
300	13.491	35.276	4.32	0.02
400	10.005	34.802	5.11	0.01
500	8.437	34.614	4.52	0.01

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml・l^{-1}	μg/l
Sur.	0	***	28.4	***	***	***
1	200	201	16.754	34.964	2.72	0.02
2	200	201	16.772	34.968	2.69	0.02
3	200	201	16.7	34.960	2.68	0.02
4	200	201	16.711	34.956	2.68	0.02
5	201	202	16.638	34.952	2.67	0.02
6	90	90	24.960	34.767	4.42	0.26
7	89	90	24.941	34.763	4.40	0.27
8	90	90	24.953	34.763	4.47	0.26
9	90	90	24.957	34.765	4.41	0.28
10	90	91	24.958	34.767	4.45	0.26
11	99	100	23.856	34.847	4.14	0.24
12	100	100	23.876	34.848	4.15	0.24
13	101	101	23.869	34.851	4.15	0.25
14	100	101	23.939	34.842	4.16	0.25
15	100	101	23.900	34.846	4.15	0.25
16	49	49	27.432	34.537	4.52	0.06
17	50	50	27.442	34.538	4.53	0.06
18	49	49	27.440	34.537	4.52	0.06
19	49	50	27.451	34.538	4.53	0.06
20	49	49	27.458	34.536	4.52	0.06
21	5	5	29.000	34.042	4.33	0.03
22	5	5	28.998	34.042	4.34	0.03
23	5	5	28.990	34.042	4.33	0.03
24	5	6	28.997	34.045	4.33	0.03

KH-09-5_Leg6	St.10	Depth	3286 m
Date:	2010.2.22	Lat.	12 08.36S
Time:	11:35	Long.	102 31.36E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml・l^{-1}	μg/l
5	29.831	34.413	4.31	0.02
10	29.836	34.415	4.31	0.02
20	29.127	34.573	4.37	0.03
30	28.789	34.596	4.39	0.03
40	27.513	34.482	4.59	0.03
50	26.880	34.506	4.64	0.05
75	25.281	34.499	4.54	0.11
100	23.212	34.597	3.58	0.27
125	20.623	34.691	2.80	0.09
150	18.861	34.755	2.58	0.05
175	15.469	34.626	2.39	0.02
200	14.114	34.653	2.31	0.02
250	12.337	34.649	2.26	0.03
300	11.488	34.724	2.35	0.03
400	9.757	34.720	2.83	0.02
500	8.198	34.651	2.28	0.02

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml・l^{-1}	μg/l
Sur.	0	***	29.8	***	***	***
1	200	201	14.079	34.653	2.29	0.03
2	199	200	14.088	34.654	2.30	0.02
3	200	201	14.080	34.654	2.30	0.02
4	199	201	14.094	34.653	2.30	0.03
5	200	201	14.098	34.654	2.30	0.02
6	91	91	23.600	34.553	3.82	0.31
7	91	91	23.636	34.562	3.78	0.31
8	90	90	23.687	34.564	3.84	0.31
9	89	89	23.772	34.570	3.99	0.32
10	89	90	23.787	34.571	4.03	0.32
11	99	100	22.404	34.629	3.30	0.19
12	99	100	22.430	34.623	3.30	0.20
13	100	100	22.434	34.623	3.34	0.18
14	100	101	22.382	34.654	3.29	0.19
15	99	99	22.444	34.622	3.31	0.19
16	50	50	27.233	34.562	4.62	0.05
17	49	50	27.253	34.553	4.61	0.05
18	50	50	27.237	34.565	4.62	0.05
19	50	50	27.243	34.562	4.62	0.05
20	49	50	27.301	34.541	4.62	0.05
21	5	5	29.777	34.416	4.30	0.02
22	5	5	29.786	34.416	4.31	0.02
23	5	5	29.787	34.416	4.31	0.02
24	5	5	29.782	34.416	4.30	0.02

KH-09-5_Leg6	St.11	Depth	5194 m
Date:	2010.2.23	Lat.	11 20.59S
Time:	15:22	Long.	109 08.13E

CTD data (LAY)

Pres.	Temp.	Sal	DO	FLC
db	℃	(psu)	ml·l^{-1}	μg/l
5	30.291	33.603	4.31	0.03
10	30.238	33.606	4.30	0.03
20	30.204	33.690	4.32	0.03
30	29.819	34.358	4.39	0.03
40	29.226	34.448	4.41	0.04
50	29.035	34.602	4.42	0.06
75	25.058	34.457	3.88	0.30
100	22.294	34.622	3.09	0.12
125	18.525	34.567	2.74	0.04
150	17.561	34.584	2.67	0.03
175	15.963	34.541	2.63	0.02
200	15.092	34.711	2.45	0.02
250	12.333	34.677	2.34	0.03
300	11.342	34.757	2.48	0.02
400	9.619	34.725	2.06	0.03
500	8.163	34.649	2.34	0.03

CTD data (BTL)

BTL	Depth	Pres.	Temp.	Sal	DO	FLC
No.	m	db	℃	(psu)	ml·l^{-1}	μg/l
Sur.	0	***	30.2	***	***	***
1	200	201	14.735	34.637	2.42	0.02
2	199	200	14.669	34.637	2.42	0.02
3	200	201	14.7	34.631	2.42	0.02
4	200	201	14.629	34.627	2.43	0.02
5	201	202	14.468	34.611	2.43	0.02
6	66	66	25.507	34.353	4.08	0.36
7	66	66	25.515	34.362	4.04	0.39
8	66	67	25.463	34.291	3.98	0.41
9	66	66	25.536	34.276	3.95	0.41
10	66	67	25.529	34.262	3.94	0.42
11	99	99	22.222	34.612	3.05	0.11
12	101	101	22.236	34.617	3.06	0.11
13	98	99	22.317	34.615	3.06	0.11
14	99	100	22.316	34.616	3.07	0.11
15	100	100	22.307	34.615	3.05	0.11
16	51	51	29.002	34.594	4.40	0.07
17	50	50	29.003	34.593	4.41	0.07
18	51	51	29.027	34.600	4.41	0.06
19	50	50	29.027	34.595	4.41	0.06
20	51	52	29.023	34.602	4.40	0.06
21	6	6	30.244	33.612	4.30	0.03
22	6	6	30.246	33.613	4.30	0.03
23	6	6	30.246	33.613	4.30	0.03
24	6	6	30.245	33.612	4.31	0.03

Date (YYMMDD)	Time (hhmm)	Time Difference between Ship Time and UTC	Latitude	Longitude	Water Depth (m)	Station Name	Heading (deg.)	Log Speed (knot)	System Course (deg.)	System Speed (knot)	Current Direction (deg.)	Current Speed (knot)	Distance (mile)	Comment
100129	1502	+04:00	20 09.225S	057 29.764E	0		127	0.2	158	0			0.1	PILOT CAME ON BOARD
100129	1511	+04:00	20 09.225S	057 29.764E	0		127	0.2	104	0.1			0.1	LET GO ALL LINES
100129	1530	+04:00	20 08.750S	057 28.939E	0		304	4.2	307	4.1	78	0.5	1.1	PILOT LEFT HER
100129	1555	+04:00	20 06.267S	057 25.294E	0		300	16.6	303	16.2	50	1.1	5.4	R/UP ENG'S
100129	1555	+04:00	20 06.262S	057 25.286E	0		300	16.6	305	16.1	50	1.1	5.4	S/CO ON 303°
100129	1856	+04:00	19 39.133S	056 40.743E	0		305	16.3	306	16.2	316	0.2	55.2	SUNSET & PUT ON REGULATION LIGHTS
100129	2214	+04:00	19 09.850S	055 54.511E	0		300	16.9	301	15.8	96	0.8	108	CLEARED OUT EEZ OF MAURITIUS
100129	2214	+04:00	19 09.818S	055 54.455E	0		300	16.5	300	15.8	37	0.3	108	ENTERED EEZ OF FRANCE
100130	543	+04:00	18 02.881S	054 06.490E	4705		303	16.1	301	16.1	183	0.3	230.2	TURNED OFF AIS
100130	555	+04:00	18 01.011S	054 03.568E	4729		305	16.6	304	16	201	0.3	233.5	S/B ENG'S
100130	605	+04:00	18 00.092S	054 02.093E	4788		304	3.9	294	4.1	193	0.4	235.3	STOPPED ENG'S
100130	609	+04:00	18 00.046S	054 01.990E	4778		303	0.6	356	0.7			235.4	SUNRISE & TURNED OFF REGULATION LIGHTS
100130	619	+04:00	18 00.048S	054 01.910E	4775	St.1	180	0.2	190	0.5			235.6	CTD-CMS STARTED
100130	637	+04:00	18 00.086S	054 01.793E	4770	St.1	180	0.3	136	0.6			235.8	CTD-CMS DEEPEST
100130	659	+04:00	18 00.221S	054 01.622E	4775	St.1	180	0.3	239	0.7			236.1	CTD-CMS FINISHED
100130	710	+04:00	18 00.169S	054 01.571E	4782	St.1	0	1.8	334	2.2			236.3	IKMT NET STARTED
100130	746	+04:00	17 58.788S	054 01.277E	4759	St.1	360	2	23	2	299	0.8	237.7	IKMT NET DEEPEST
100130	838	+04:00	17 57.332S	054 01.189E	4653	St.1	10	1.6	357	1.4			239.3	IKMT NET FINISHED
100130	849	+04:00	17 57.207S	054 01.160E	4649		58	0.4	359	0.6			239.5	CHANGED ENG'S TO T/M
100130	849	+04:00	17 57.207S	054 01.160E	4649		58	0.4	6	1			239.5	SLOW AHEAD ENG'S
100130	853	+04:00	17 57.105S	054 01.190E	4628		4	4.2	13	4.1	309	0.4	239.6	S/CO ON 000°
100130	910	+04:00	17 53.602S	054 01.442E	4504		6	16.3	8	15.6	230	0.6	243.2	R/UP ENG'S
100130	1200	+04:00	17 09.081S	054 02.033E	4639		2	16.3	2	15.9	181	1.3	287.5	COM'CED LIFEBOAT STATION DRILL
100130	1215	+04:00	17 05.153S	054 02.088E	4709		0	16.3	0	15.2	173	1	291.4	FINISHED LIFEBOAT STATION DRILL
100130	1228	+04:00	17 01.612S	054 02.025E	4674		358	16.6	358	15.8	188	0.9	294.8	S/B ENG'S & USED HELM VAR'LY
100130	1246	+04:00	16 59.759S	054 01.999E	4696		43	0.6	141	1.3			296.9	CHANGED ENG'S TO E/M
100130	1257	+04:00	16 59.943S	054 02.063E	4699		269	0.1	150	1.6			297.1	CTD STARTED
100130	1319	+04:00	17 00.248S	054 02.174E	4704	St.2	199	0.1	115	1			297.5	CTD DEEPEST
100130	1334	+04:00	17 00.374S	054 02.301E	4710	St.2	180	0.1	172	0.9			297.7	CTD FINISHED
100130	1347	+04:00	17 00.475S	054 02.390E	4717	St.2	0	1.5	13	0.8			298	IKMT NET STARTED
100130	1416	+04:00	16 59.664S	054 02.551E	4727	St.2	360	2.4	17	1.3			298.9	IKMT NET DEEPEST
100130	1457	+04:00	16 59.012S	054 03.032E	4706	St.2	10	1.3	74	1.6			299.8	IKMT NET FINISHED
100130	1506	+04:00	16 59.010S	054 03.160E	4703	St.2	3	0.7	104	0.8			299.9	CHANGED ENG'S TO T/M
100130	1534	+04:00	16 54.883S	054 03.329E	4734		358	17.1	1	16.2	152	1	304.2	R/UP ENG'S & S/CO ON 000°
100130	1851	+04:00	16 01.765S	054 02.080E	4460		1	16.1	2	16.2	167	0.3	357.1	S/B ENG'S
100130	1903	+04:00	15 59.974S	054 02.069E	4567		0	1.1	6	1			358.8	STOPPED ENG'S
100130	1903	+04:00	15 59.972S	054 02.069E	4568		0	1.1	7	1.2			358.8	SUNSET & PUT ON REGULATION LIGHTS
100130	1908	+04:00	15 59.909S	054 02.085E	4568		8	0.6	47	0.9			358.9	CHANGED ENG'S TO E/M
100130	1913	+04:00	15 59.896S	054 02.104E	4572	St.3	180	0.3	170	1.3			358.9	CTD-CMS STARTED
100130	1933	+04:00	15 59.929S	054 02.119E	4566	St.3	180	0.2	135	0.3			359.2	CTD-CMS DEEPEST
100130	1951	+04:00	15 59.995S	054 02.118E	4567	St.3	180	0.6	141	0.6			359.4	CTD-CMS FINISHED
100130	2000	+04:00	15 59.911S	054 02.074E	4566	St.3	0	1.8	14	1.9			359.6	IKMT NET STARTED
100130	2013	+04:00	15 59.335S	054 02.063E	4556	St.3	359	2.4	2	2.4	248	0.1	360.2	IKMT NET DEEPEST
100130	2135	+04:00	15 55.790S	054 01.802E	4536	St.3	0	1.2	10	1.5	355	4.6	363.9	IKMT NET FINISHED
100130	2144	+04:00	15 55.579S	054 01.772E	4556		2	2.6	5	3	334	0.6	364.1	CHANGED ENG'S TO T/M
100130	2144	+04:00	15 55.578S	054 01.772E	4556		2	2.9	4	2.9	334	0.6	364.1	SLOW AHEAD ENG'S
100130	2144	+04:00	15 55.569S	054 01.772E	4556		1	3.2	359	3.9	339	0.6	364.1	S/CO ON 000°
100130	2200	+04:00	15 52.721S	054 01.846E	4405		4	16.1	1	16.4	282	0.4	367.1	R/UP ENG'S
100131	105	+04:00	15 02.024S	054 01.998E	4581		0	16.5	0	16.6	273	0.2	417.5	S/B ENG'S
100131	118	+04:00	14 59.878S	054 01.984E	4570		6	0.8	4	1.8			419.7	STOPPED ENG'S
100131	122	+04:00	14 59.842S	054 01.999E	4571	St.4	40	0.4	344	0.5			419.8	CHANGED ENG'S TO E/M
100131	131	+04:00	14 59.810S	054 01.983E	4569	St.4	309	0.1	313	0.2			419.9	CTD STARTED
100131	152	+04:00	14 59.833S	054 01.840E	4569	St.4	303	0.1	174	0.5			420.2	CTD DEEPEST
100131	207	+04:00	14 59.888S	054 01.781E	4569	St.4	304	0	22	0.6			420.4	CTD FINISHED
100131	212	+04:00	14 59.850S	054 01.769E	4569	St.4	352	1.2	1	2.1			420.5	IKMT NET STARTED
100131	229	+04:00	14 59.075S	054 01.676E	4491	St.4	350	2	346	2.3	15	0.4	421.3	IKMT NET DEEPEST
100131	347	+04:00	14 56.610S	054 01.161E	4535	St.4	0	1	26	0.7			424	IKMT NET FINISHED
100131	358	+04:00	14 56.469S	054 01.128E	4533		346	0.5	260	1.2			424.3	CHANGED ENG'S TO T/M
100131	403	+04:00	14 56.203S	054 01.097E	4515		11	6.3	2	6.1	278	0.4	424.6	S/CO ON 000°
100131	416	+04:00	14 53.589S	054 01.391E	4528		6	16.3	2	15.9	262	0.5	427.1	R/UP ENG'S
100131	614	+04:00	14 22.021S	054 02.201E	3627		357	16.8	0	16.1	113	0.7	458.6	SUNRISE & TURNED OFF REGULATION LIGHTS
100131	729	+04:00	14 01.774S	054 01.976E	4260		0	16.5	2	16.1	122	0.5	478.7	S/B ENG'S
100131	739	+04:00	14 00.159S	054 02.076E	4227		350	4.3	7	4.2	115	1	480.4	STOPPED ENG'S
100131	746	+04:00	14 00.121S	054 02.206E	4227		49	0.4	105	1.2			480.6	CHANGED ENG'S TO E/M
100131	752	+04:00	14 00.188S	054 02.300E	4224	St.5	300	0.2	117	1.6			480.8	CTD STARTED
100131	809	+04:00	14 00.290S	054 02.347E	4213	St.5	300	0.2	159	0.7			481	CTD DEEPEST
100131	825	+04:00	14 00.377S	054 02.487E	4186	St.5	300	0.5	57	0.4			481.2	CTD FINISHED
100131	836	+04:00	14 00.330S	054 02.394E	4200	St.5	300	2.6	278	2.6	13	0.1	481.4	IKMT NET STARTED
100131	905	+04:00	13 59.470S	054 02.220E	4241	St.5	331	2.4	14	1.9			482.4	IKMT NET DEEPEST
100131	948	+04:00	13 58.347S	054 02.058E	4262	St.5	300	1.9	288	1.3			483.7	IKMT NET FINISHED
100131	957	+04:00	13 58.259S	054 02.071E	4264		359	1.8	39	2.3	332	11.4	483.9	CHANGED ENG'S TO T/M
100131	957	+04:00	13 58.258S	054 02.072E	4264		359	1.8	22	2.3	332	11.4	483.9	SLOW AHEAD ENG'S
100131	957	+04:00	13 58.251S	054 02.076E	4263		1	2.3	25	2.8	340	9.4	483.9	S/CO ON 000°
100131	1017	+04:00	13 54.845S	054 02.174E	4324		355	16.5	359	16.1	108	1.2	487.2	R/UP ENG'S
100131	1333	+04:00	13 02.232S	054 01.990E	4614		358	16.1	358	16.3	28	0.3	539.8	S/B ENG'S
100131	1349	+04:00	13 00.158S	054 02.047E	4615		8	0.9	73	0.7			541.9	STOPPED ENG'S
100131	1351	+04:00	13 00.162S	054 02.077E	4614		31	0.4	86	1.9			541.9	CHANGED ENG'S TO E/M
100131	1402	+04:00	13 00.255S	054 02.227E	4612		302	0.1	87	1.7			542.1	CTD-CMS STARTED
100131	1421	+04:00	13 00.305S	054 02.137E	4613		289	0.5	213	1.3			542.4	CTD-CMS DEEPEST
100131	1442	+04:00	13 00.306S	054 01.925E	4615		291	0.2	335	1.1			542.8	CTD-CMS FINISHED
100131	1450	+04:00	13 00.232S	054 01.979E	4614		323	1.2	359	1.6			542.9	IKMT NET STARTED
100131	1523	+04:00	12 58.782S	054 01.930E	4618		341	2.1	14	3.3	59	0.8	544.4	IKMT NET DEEPEST
100131	1614	+04:00	12 57.401S	054 02.379E	4625	St.6	68	1.7	82	1.6	99	6.5	546.2	IKMT NET FINISHED
100131	1626	+04:00	12 57.379S	054 02.732E	4623		57	2.5	60	3.9	108	0.9	546.6	CHANGED ENG'S TO T/M
100131	1627	+04:00	12 57.369S	054 02.807E	4623		95	4.5	81	5.1	132	0.5	546.6	S/CO ON 090°
100131	1642	+04:00	12 57.468S	054 05.561E	4628		96	17.5	96	16.3	260	0.5	549.5	R/UP ENG'S
100131	1855	+04:00	12 59.983S	054 42.529E	4222		90	16.1	91	16.4	254	0.1	585.5	SUNSET & PUT ON REGULATION LIGHTS
100131	1943	+04:00	13 00.075S	054 56.131E	4072		89	16.8	91	16.3	126	0.3	598.9	ENTERED EEZ OF MURITIUS
100131	1952	+04:00	13 00.039S	054 58.772E	4021		90	16.3	90	16.3	97	0.1	601.4	S/B ENG'S
100131	2000	+04:00	12 59.981S	055 00.025E	3963		2	2.3	4	1.6			602.7	STOPPED ENG'S
100131	2007	+04:00	12 59.940S	055 00.138E	3954		21	0.7	8	0.4			602.9	CHANGED ENG'S TO E/M
100131	2013	+04:00	12 59.871S	055 00.164E	3949	St.7	290	1.7	316	2			603.1	IKMT NET STARTED
100131	2030	+04:00	12 59.633S	054 59.553E	3885	St.7	291	2.1	286	2.2	312	0.6	603.8	IKMT NET DEEPEST
100131	2149	+04:00	12 58.343S	054 56.474E	4046	St.7	290	1.1	274	1.3	299	4.3	607.2	IKMT NET FINISHED
100131	2158	+04:00	12 58.408S	054 56.445E	4047		176	3	168	2.9	130	0.9	607.4	CHANGED ENG'S TO T/M
100131	2158	+04:00	12 58.409S	054 56.445E	4047		176	3	175	3.1	130	0.9	607.4	SLOW AHEAD ENG'S
100131	2158	+04:00	12 58.417S	054 56.447E	4048		175	3.5	158	3.9	118	0.6	607.4	S/CO ON 180°
100131	2211	+04:00	13 00.309S	054 56.644E	4067		175	12.1	172	12.2	100	0.3	609.4	CLEARED OUT EEZ OF MAURITIUS
100131	2211	+04:00	13 00.313S	054 56.644E	4067		176	12.1	176	12	100	0.3	609.4	ENTERED EEZ OF FRANCE
100131	2220	+04:00	13 02.381S	054 56.870E	4093		174	15.9	174	16.3	31	0.2	611.3	R/UP ENG'S
100201	153	+04:00	13 58.102S	055 00.043E	4499		180	16.2	178	15.5	10	0.8	667	S/B ENG'S
100201	208	+04:00	13 59.941S	055 00.072E	4516		222	0.4	34	1			669.1	STOPPED ENG'S
100201	209	+04:00	13 59.936S	055 00.077E	4517		217	0.9	72	2.1	21	1.4	669.1	CHANGED ENG'S TO E/M
100201	213	+04:00	13 59.938S	055 00.029E	4518	St.8	255	1.6	282	1.8			669.2	IKMT NET STARTED
100201	232	+04:00	13 59.786S	054 59.214E	4502	St.8	270	2.1	281	2.7	346	0.9	670	IKMT NET DEEPEST
100201	357	+04:00	13 58.180S	054 57.279E	4480	St.8	126	1.1	46	1.1			673.1	IKMT NET FINISHED
100201	407	+04:00	13 58.255S	054 57.179E	4484		187	2.1	194	0.6			673.3	CHANGED ENG'S TO T/M

KH-09-5 Leg5

Date (YYMMDD)	Time (hhmm)	Time Difference between Ship Time and UTC	Latitude	Longitude	Water Depth (m)	Station Name	Heading (deg.)	Log Speed (knot)	System Course (deg.)	System Speed (knot)	Current Direction (deg.)	Current Speed (knot)	Distance (mile)	Comment
100201	408	+04:00	13 58.271S	054 57.172E	4483		169	2.4	186	1.4			673.3	S/CO ON 175°
100201	424	+04:00	14 00.766S	054 57.515E	4504		171	16.3	173	15.8	327	1.3	675.8	R/UP ENG'S
100201	611	+04:00	14 28.133S	054 59.688E	4482		178	16.5	179	15.6	350	0.4	703.4	SUNRISE & TURNED OFF REGULATION LIGHTS
100201	805	+04:00	14 58.762S	054 59.959E	4318		178	16.1	181	15.5	335	0.7	733.7	S/B ENG'S
100201	816	+04:00	14 59.986S	055 00.040E	4203		70	1.1	76	1.3			735.1	STOPPED ENG'S
100201	818	+04:00	14 59.975S	055 00.048E	4204		65	0.7	25	2.1			735.1	CHANGED ENG'S TO E/M
100201	824	+04:00	14 59.907S	055 00.077E	4223	St.9	30	2.1	13	2.6	31	5.8	735.2	IKMT NET STARTED
100201	900	+04:00	14 58.134S	055 00.087E	4467	St.9	348	2.6	342	2.9	325	0.5	737.1	IKMT NET DEEPEST
100201	1000	+04:00	14 55.767S	054 59.357E	4545	St.9	355	1.2	2	1			739.7	IKMT NET FINISHED
100201	1012	+04:00	14 56.071S	054 59.452E	4543		165	2.8	175	2.9	258	0.4	740.2	CHANGED ENG'S TO T/M
100201	1012	+04:00	14 56.072S	054 59.452E	4543		165	2.8	170	2.8	258	0.4	740.2	SLOW AHEAD ENG'S
100201	1012	+04:00	14 56.077S	054 59.453E	4544		166	2.9	174	2.7	269	0.3	740.2	S/CO ON 180°
100201	1034	+04:00	15 00.125S	054 59.396E	4080		179	16.8	179	16.5	309	0.4	744.3	R/UP ENG'S
100201	1407	+04:00	15 57.984S	054 59.995E	4611		180	16.5	181	16	100	0.1	801.8	S/B ENG'S
100201	1423	+04:00	15 59.964S	055 00.037E	4619		200	0.6	140	0.6			803.9	STOPPED ENG'S
100201	1425	+04:00	15 59.983S	055 00.059E	4622		193	0.7	144	0.8			803.9	CHANGED ENG'S TO E/M
100201	1429	+04:00	16 00.011S	055 00.079E	4620	St.10	301	0.3	96	0.5			804	CTD-CMS STARTED
100201	1449	+04:00	16 00.085S	055 00.024E	4622	St.10	268	0.7	211	0.8			804.3	CTD-CMS DEEPEST
100201	1511	+04:00	16 00.182S	054 59.863E	4619	St.10	280	0.2	170	0.8			804.7	CTD-CMS FINISHED
100201	1520	+04:00	16 00.209S	054 59.856E	4619	St.10	299	1	277	1.1			804.8	IKMT NET STARTED
100201	1552	+04:00	15 59.502S	054 58.579E	4618	St.10	302	2.4	296	2.6	302	0.4	806.3	IKMT NET DEEPEST
100201	1642	+04:00	15 58.655S	054 56.919E	4615	St.10	301	1.3	294	1.7			808.2	IKMT NET FINISHED
100201	1656	+04:00	15 58.877S	054 56.830E	4616	St.10	175	2.6	176	2.3	186	9.1	808.5	CHANGED ENG'S TO T/M
100201	1656	+04:00	15 58.890S	054 56.831E	4618		174	2.8	170	2.6	186	9	808.6	SLOW AHEAD ENG'S
100201	1656	+04:00	15 58.896S	054 56.832E	4618		174	2.9	171	2.5	186	8.8	808.6	S/CO ON 180°
100201	1709	+04:00	16 01.047S	054 57.179E	4615		172	15.9	172	15.8	326	0.5	810.8	R/UP ENG'S
100201	1856	+04:00	16 29.759S	054 59.102E	4761		175	16.3	176	16.3	248	0.7	839.3	SUNSET & PUT ON REGULATION LIGHTS
100201	2040	+04:00	16 58.642S	054 59.983E	4643		175	16.5	177	16.8	199	0.4	868.2	S/B ENG'S
100201	2041	+04:00	16 58.675S	054 59.985E	4661		177	16.8	179	16.8	206	0.4	868.2	USED ENG'S VAR'LY
100201	2042	+04:00	16 59.034S	054 59.998E	4426		177	14.5	179	14.7	245	0.3	868.5	USED HELM VAR'LY
100201	2050	+04:00	17 00.023S	054 59.980E	4276		187	1.3	189	2.1	197	0.6	869.6	STOPPED ENG'S
100201	2051	+04:00	17 00.079S	054 59.970E	4282		193	1.5	178	1.8	191	4	869.6	CHANGED ENG'S TO E/M
100201	2056	+04:00	17 00.245S	054 59.950E	4260	St.11	180	2.8	179	3	195	0.3	869.8	IKMT NET STARTED
100201	2116	+04:00	17 01.182S	054 59.912E	4571	St.11	180	2.3	182	2.6	192	0.4	870.8	IKMT NET DEEPEST
100201	2239	+04:00	17 04.813S	054 59.929E	4419	St.11	180	1.8	175	2.1			874.5	IKMT NET FINISHED
100201	2250	+04:00	17 05.452S	054 59.935E	4573		199	1.8	196	1.9	164	0.6	875.2	CHANGED ENG'S TO T/M
100201	2250	+04:00	17 05.452S	054 59.934E	4573		199	1.8	193	2			875.2	SLOW AHEAD ENG'S
100201	2250	+04:00	17 05.456S	054 59.934E	4573		198	1.8	197	1.8	168	0.8	875.2	S/CO ON 180°
100201	2309	+04:00	17 08.800S	054 59.993E	4407		181	16.8	180	16.8	143	0.3	878.6	R/UP ENG'S
100202	209	+04:00	17 58.289S	055 00.023E	4591		180	15.9	178	16	11	0.7	927.9	S/B ENG'S
100202	222	+04:00	18 00.180S	055 00.031E	4590		203	0.7	263	0.9			929.8	STOPPED ENG'S
100202	224	+04:00	18 00.185S	055 00.015E	4589		227	0.7	243	1.3			929.9	CHANGED ENG'S TO E/M
100202	230	+04:00	18 00.209S	055 00.053E	4588		80	1.9	78	2.2	172	3.6	930	IKMT NET STARTED
100202	250	+04:00	17 59.884S	055 00.830E	4588		69	2.1	54	2.2	325	0.5	930.9	IKMT NET DEEPEST
100202	407	+04:00	17 58.589S	055 02.858E	4586	St.12	39	1.5	7	1.9			933.5	IKMT NET FINISHED
100202	420	+04:00	17 58.496S	055 03.271E	4588		96	2.5	106	2.2	19	0.2	933.9	CHANGED ENG'S TO T/M
100202	420	+04:00	17 58.497S	055 03.275E	4587		96	2.5	79	2.6	25	0.2	933.9	S/CO ON 090°
100202	433	+04:00	17 58.556S	055 05.634E	4587		93	16.6	92	16.1	316	0.7	936.2	R/UP ENG'S
100202	604	+04:00	17 59.594S	055 31.282E	4593		92	16.9	90	16.5	335	0.3	960.8	SUNRISE & TURNED OFF REGULATION LIGHTS
100202	718	+04:00	18 00.013S	055 52.253E	4571		92	16.5	92	15.9	288	0.4	980.7	ENTERED EEZ OF MURITIUS
100202	741	+04:00	17 59.995S	055 58.468E	4574		91	16.3	89	15.7	293	0.8	986.8	S/B ENG'S
100202	752	+04:00	18 00.022S	056 00.003E	4313		88	0.6	168	1.5			988.2	STOPPED ENG'S
100202	753	+04:00	18 00.031S	056 00.007E	4322		93	0.8	192	0.6			988.2	CHANGED ENG'S TO E/M
100202	757	+04:00	18 00.027S	056 00.012E	4327	St.13	34	0.6	4	0.4			988.3	CTD-CMS STARTED
100202	829	+04:00	18 00.037S	055 59.707E	4483	St.13	14	0.1	262	1.1			988.8	CTD-CMS DEEPEST
100202	855	+04:00	18 00.099S	055 59.358E	4551	St.13	10	0.2	238	0.7			989.3	CTD-CMS FINISHED
100202	905	+04:00	17 59.862S	055 59.394E	4565	St.13	30	2.5	36	2.6	265	0.4	989.6	IKMT NET STARTED
100202	937	+04:00	17 58.723S	055 59.797E	4573	St.13	30	2.5	12	2	269	0.5	990.9	IKMT NET DEEPEST
100202	1031	+04:00	17 56.778S	056 00.310E	4570	St.13	25	1.6	348	1.3			993.1	IKMT NET FINISHED
100202	1041	+04:00	17 56.224S	056 00.213E	4567		2	3	344	3.8	282	0.9	993.7	CHANGED ENG'S TO T/M
100202	1041	+04:00	17 56.220S	056 00.213E	4565		2	3.3	350	3.7	286	0.9	993.7	SLOW AHEAD ENG'S
100202	1041	+04:00	17 56.213S	056 00.211E	4565		2	3.4	346	3.9	289	0.9	993.7	S/CO ON 000°
100202	1056	+04:00	17 53.821S	056 00.002E	4561		360	14.6	357	15.4	294	0.8	996	CLEARED OUT EEZ OF MAURITIUS
100202	1056	+04:00	17 53.813S	056 00.002E	4561		360	15	357	15.6	294	0.8	996	ENTERED EEZ OF FRANCE
100202	1100	+04:00	17 52.959S	056 00.010E	4556		5	16.6	0	16.5	296	0.8	996.8	R/UP ENG'S
100202	1404	+04:00	17 02.056S	055 59.954E	4495		3	16.2	2	16.1	86	0.3	1047.6	S/B ENG'S
100202	1417	+04:00	17 00.013S	056 00.032E	4475		10	0.5	358	0.9			1049.5	STOPPED ENG'S
100202	1420	+04:00	16 59.984S	056 00.055E	4486		32	0.5	79	1.6			1049.6	CHANGED ENG'S TO E/M
100202	1427	+04:00	16 59.943S	056 00.108E	4485	St.14	10	0.4	72	0.6			1049.7	CTD STARTED
100202	1445	+04:00	16 59.919S	056 00.114E	4458	St.14	340	0.5	51	1.3			1050	CTD DEEPEST
100202	1500	+04:00	16 59.846S	056 00.100E	4483	St.14	0	0.1	97	0.7			1050.2	CTD FINISHED
100202	1507	+04:00	16 59.850S	056 00.132E	4479	St.14	5	0	356	1.6			1050.3	IKMT NET STARTED
100202	1541	+04:00	16 58.344S	056 00.262E	4484	St.14	359	1.9	0	2.7	358	0.7	1051.8	IKMT NET DEEPEST
100202	1632	+04:00	16 56.263S	056 00.421E	4481	St.14	10	1.6	21	2.1	1	0.7	1054.1	IKMT NET FINISHED
100202	1643	+04:00	16 55.786S	056 00.446E	4466	St.14	6	2.6	9	3.5	7	0.8	1054.6	CHANGED ENG'S TO T/M
100202	1644	+04:00	16 55.755S	056 00.450E	4470		5	3.3	8	4.6	7	0.9	1054.6	SLOW AHEAD ENG'S
100202	1655	+04:00	16 53.750S	056 00.364E	4320		356	16.1	356	16.5	0	0.6	1056.5	R/UP ENG'S
100202	1854	+04:00	16 20.599S	055 59.904E	4336		2	16.6	0	16.5	328	0.6	1089.6	SUNSET & PUT ON REGULATION LIGHTS
100202	2000	+04:00	16 01.960S	055 59.968E	3982		2	16.1	0	16.7	277	0.6	1108.1	S/B ENG'S
100202	2011	+04:00	16 00.105S	055 59.965E	4134		353	0.6	290	1.9			1110.1	STOPPED ENG'S
100202	2013	+04:00	16 00.099S	055 59.951E	4172		354	0.5	292	0.8			1110.1	CHANGED ENG'S TO E/M
100202	2024	+04:00	16 00.126S	055 59.897E	4110	St.15	20	0.2	230	0.9			1110.2	CTD-CMS STARTED
100202	2042	+04:00	16 00.149S	055 59.723E	4108	St.15	5	0.3	220	0.6			1110.5	CTD-CMS DEEPEST
100202	2112	+04:00	16 00.159S	055 59.465E	4243	St.15	0	0.3	291	0.3			1110.9	CTD-CMS FINISHED
100202	2124	+04:00	15 59.988S	055 59.386E	5	St.15	360	2.6	348	2.6	270	0.7	1111.2	IKMT NET STARTED
100202	2139	+04:00	15 59.399S	055 59.294E	6	St.15	16	2.5	8	2			1111.9	IKMT NET DEEPEST
100202	2302	+04:00	15 56.590S	055 59.385E	4534	St.15	15	1.4	1	1.1			1114.9	IKMT NET FINISHED
100202	2312	+04:00	15 56.156S	055 59.319E	4537		357	2.5	3	2.3	246	0.8	1115.3	CHANGED ENG'S TO T/M
100202	2312	+04:00	15 56.151S	055 59.316E	4533		357	2.5	341	2.7	243	0.9	1115.3	SLOW AHEAD ENG'S
100202	2312	+04:00	15 56.146S	055 59.315E	4537		358	2.6	328	2.6	244	0.7	1115.3	S/CO ON 000°
100202	2335	+04:00	15 52.074S	055 59.616E	4503		2	16.3	2	16.1	212	0.7	1119.4	R/UP ENG'S
100203	239	+04:00	15 01.832S	055 59.984E	4413		359	16.6	358	15.9	192	0.6	1169.4	S/B ENG'S
100203	252	+04:00	14 59.974S	055 59.942E	4410		22	0.8	41	1.1			1171.3	STOPPED ENG'S
100203	254	+04:00	14 59.950S	055 59.959E	4323		38	0.4	65	0.6			1171.4	CHANGED ENG'S TO E/M
100203	301	+04:00	14 59.786S	055 59.987E	4326	St.16	360	2.4	9	2.2	9	0.1	1171.6	IKMT NET STARTED
100203	318	+04:00	14 59.016S	055 59.939E	4325	St.16	359	2.2	1	2.7	311	0.3	1172.3	IKMT NET DEEPEST
100203	433	+04:00	14 56.157S	055 59.600E	4195	St.16	350	1.5	339	2.1	344	1.4	1175.3	IKMT NET FINISHED
100203	442	+04:00	14 56.000S	055 59.521E	4189	St.16	325	0.1	342	1.1			1175.5	CTD STARTED
100203	459	+04:00	14 55.934S	055 59.439E	4175	St.16	324	0.1	63	1.4			1175.8	CTD DEEPEST
100203	513	+04:00	14 55.950S	055 59.417E	4185	St.16	326	0	12	0.4			1176	CTD FINISHED
100203	527	+04:00	14 55.547S	055 59.328E	4190	St.16	11	2.5	7	2.9	329	1	1176.5	CHANGED ENG'S TO T/M
100203	545	+04:00	14 52.189S	055 59.839E	4198		8	16.3	7	16.6	271	0.5	1179.9	R/UP ENG'S
100203	607	+04:00	14 46.131S	055 59.982E	4326		0	17.1	1	17.2	46	0.3	1186	SUNRISE & TURNED OFF REGULATION LIGHTS
100203	849	+04:00	14 01.394S	056 00.016E	4388		0	16.1	0	16.5	209	0.1	1230.6	S/B ENG'S
100203	858	+04:00	14 00.220S	056 00.018E	4400		22	1.1	21	0.9			1231.7	STOPPED ENG'S
100203	900	+04:00	14 00.220S	056 00.025E	4403		49	0.2	141	1.5			1231.7	CHANGED ENG'S TO E/M
100203	909	+04:00	14 00.235S	056 00.056E	4400	St.16	15	0.4	109	0.4			1231.8	CTD STARTED

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Date (YYMMDD)	Time (hhmm)	Time Difference between Ship Time and UTC	Latitude	Longitude	Water Depth (m)	Station Name	Heading (deg.)	Log Speed (knot)	System Course (deg.)	System Speed (knot)	Current Direction (deg.)	Current Speed (knot)	Distance (mile)	Comment
100203	927	+04:00	14 00.309S	056 00.102E	4403	St.16	360	0.5	48	0.3			1232.1	CTD DEEPEST
100203	942	+04:00	14 00.336S	056 00.086E	4397	St.16	5	0.3	212	0.7			1232.3	CTD FINISHED
100203	953	+04:00	14 00.359S	056 00.075E	4397	St.16	0	2.3	358	2.2			1232.5	IKMT NET STARTED
100203	1024	+04:00	13 59.298S	056 00.197E	4409	St.16	12	2.4	17	2			1233.7	IKMT NET DEEPEST
100203	1112	+04:00	13 57.698S	056 00.488E	4413	St.16	11	1.2	61	1.8			1235.4	IKMT NET FINISHED
100203	1122	+04:00	13 57.257S	056 00.571E	4431		0	2.5	349	3	2	0.4	1235.8	CHANGED ENG'S TO T/M
100203	1122	+04:00	13 57.254S	056 00.571E	4432		1	2.5	4	2.5	12	0.3	1235.8	SLOW AHEAD ENG'S
100203	1122	+04:00	13 57.249S	056 00.571E	4435		0	2.7	349	3.1	359	0.4	1235.8	S/CO ON 000°
100203	1145	+04:00	13 53.147S	056 00.403E	4441		358	16.5	357	16.5	217	0.5	1240	R/UP ENG'S
100203	1313	+04:00	13 29.515S	056 00.041E	4364		1	15.6	0	15.4	158	0.2	1263.2	CLEARED OUT EEZ OF FRANCE
100203	1314	+04:00	13 29.510S	056 00.041E	4364		0	15.6	1	15.8	158	0.2	1263.2	ENTERED EEZ OF MAURITIUS
100203	1456	+04:00	13 01.940S	056 00.077E	4335		0	16.3	0	16	218	0.4	1290.9	S/B ENG'S
100203	1509	+04:00	13 00.015S	055 59.969E	5		344	0.8	339	0.5			1292.8	STOPPED ENG'S
100203	1512	+04:00	13 00.002S	055 59.968E	4323		349	0.6	64	0.7			1292.8	CHANGED ENG'S TO E/M
100203	1519	+04:00	13 00.008S	055 59.948E	4332	St.18	310	0.2	248	0.7			1292.9	CTD-CMS STARTED
100203	1537	+04:00	13 00.091S	055 59.776E	4337	St.18	300	0.4	296	0.4			1293.2	CTD-CMS DEEPEST
100203	1556	+04:00	13 00.222S	055 59.620E	4321	St.18	300	0.3	18	1			1293.6	CTD-CMS FINISHED
100203	1604	+04:00	13 00.277S	055 59.570E	4314	St.18	294	1.6	260	2.4	241	10.9	1293.8	IKMT NET STARTED
100203	1632	+04:00	12 59.989S	055 58.439E	4357	St.18	295	2.5	285	2.6	205	0.5	1295	IKMT NET DEEPEST
100203	1715	+04:00	12 59.727S	055 57.072E	4357	St.18	295	1.3	277	1.5			1296.5	IKMT NET FINISHED
100203	1730	+04:00	12 59.750S	055 57.480E	4349	St.18	86	2.4	108	2.4	109	7.4	1297	CHANGED ENG'S TO T/M
100203	1731	+04:00	12 59.755S	055 57.500E	4348		95	2.5	87	2.9	159	0.8	1297.1	SLOW AHEAD ENG'S
100203	1745	+04:00	12 59.937S	056 00.052E	4316		89	16.6	91	15.5	241	0.9	1299.5	R/UP ENG'S
100203	1848	+04:00	13 00.063S	056 17.381E	4312		90	16.8	92	15.9	257	1	1316.4	SUNSET & PUT ON REGULATION LIGHTS
100203	2115	+04:00	12 59.961S	056 58.613E	4347		89	16.1	89	16.1	306	0.6	1356.9	S/B ENG'S
100203	2125	+04:00	12 59.943S	057 00.002E	4343		171	1.1	181	0.8			1358.1	STOPPED ENG'S
100203	2127	+04:00	12 59.957S	057 00.013E	4348		196	1	137	0.7			1358.1	CHANGED ENG'S TO E/M
100203	2131	+04:00	13 00.021S	057 00.049E	4344	St.19	156	2.6	135	2.4	139	6.4	1358.2	IKMT NET STARTED
100203	2147	+04:00	13 00.502S	057 00.391E	4344	St.19	154	2.3	133	2.3			1358.8	IKMT NET DEEPEST
100203	2316	+04:00	13 02.450S	057 02.936E	4354	St.19	135	2.3	108	1.7	122	2.8	1362.2	IKMT NET FINISHED
100203	2328	+04:00	13 02.915S	057 03.068E	4340		190	2.6	203	2.3	202	0.3	1362.7	CHANGED ENG'S TO T/M
100203	2328	+04:00	13 02.916S	057 03.068E	4340		190	2.6	189	2.3	202	0.3	1362.7	SLOW AHEAD ENG'S
100203	2328	+04:00	13 02.919S	057 03.067E	4342		190	2.7	197	2.4	205	0.3	1362.8	S/CO ON 180°
100203	2348	+04:00	13 06.296S	057 02.521E	4345		188	16.6	185	16.3	161	0.2	1366	R/UP ENG'S
100204	257	+04:00	13 58.145S	057 00.075E	4315		180	16.1	181	15.9	16	0.3	1417.9	S/B ENG'S
100204	312	+04:00	13 59.976S	057 00.039E	4318		232	0.5	10	0.5			1419.7	STOPPED ENG'S
100204	312	+04:00	13 59.977S	057 00.039E	4317		231	0.2	216	0.2			1419.7	CHANGED ENG'S TO E/M
100204	317	+04:00	13 59.958S	056 59.971E	4319	St.20	316	1.6	310	1.9	255	4.3	1419.8	IKMT NET STARTED
100204	333	+04:00	13 59.482S	056 59.475E	4319	St.20	315	2.2	314	2.3	324	0.2	1420.5	IKMT NET DEEPEST
100204	447	+04:00	13 57.488S	056 58.040E	4315	St.20	325	1.6	338	1.4			1423.1	IKMT NET FINISHED
100204	503	+04:00	13 57.911S	056 58.018E	4315		179	3.3	170	3.4	89	0.3	1423.7	CHANGED ENG'S TO T/M
100204	504	+04:00	13 57.989S	056 58.024E	4314		176	5	169	5.1	143	0.2	1423.7	S/CO ON 180° & S/H ENG'S
100204	516	+04:00	14 00.256S	056 58.193E	4315		178	16.5	178	16.4	141	0.4	1426	R/UP ENG'S
100204	604	+04:00	14 13.530S	056 58.898E	4290		179	16.6	175	17.1	112	0.8	1439.4	SUNRISE & TURNED OFF REGULATION LIGHTS
100204	848	+04:00	14 58.649S	057 00.026E	4317		180	16.2	180	16.2	125	0.2	1484.4	S/B ENG'S
100204	859	+04:00	15 00.104S	056 59.922E	4316		300	0.8	191	1.5			1485.9	STOPPED ENG'S
100204	904	+04:00	15 00.196S	056 59.918E	4327		315	0.4	179	0.9			1486	CHANGED ENG'S TO E/M
100204	910	+04:00	15 00.269S	056 59.939E	4315	St.21	315	0.1	158	0.5			1486.1	CTD-CMS STARTED
100204	929	+04:00	15 00.417S	056 59.960E	4316	St.21	315	0.1	194	1.6			1486.3	CTD-CMS DEEPEST
100204	959	+04:00	15 00.567S	056 59.965E	4310	St.21	305	0.4	53	1			1486.6	CTD-CMS FINISHED
100204	1009	+04:00	15 00.532S	056 59.923E	5	St.21	321	2.3	326	2.3	179	12	1486.8	IKMT NET STARTED
100204	1041	+04:00	14 59.573S	056 59.052E	4317	St.21	317	2.7	312	2.8	19	0.1	1488.1	IKMT NET DEEPEST
100204	1136	+04:00	14 57.944S	056 57.664E	4341	St.21	315	1.1	308	1			1490.3	IKMT NET FINISHED
100204	1147	+04:00	14 58.140S	056 57.642E	4322		174	3	167	3.7	96	0.6	1490.7	CHANGED ENG'S TO T/M
100204	1147	+04:00	14 58.152S	056 57.645E	4322		176	3.6	167	3.8	105	0.7	1490.7	SLOW AHEAD ENG'S
100204	1147	+04:00	14 58.153S	056 57.645E	4322		176	3.6	168	3.9	105	0.7	1490.7	S/CO ON 180°
100204	1210	+04:00	15 02.574S	056 58.234E	4301		175	16.6	172	16.5	76	0.7	1495	R/UP ENG'S
100204	1529	+04:00	15 58.107S	057 00.091E	4323		180	16.5	180	16.3	178	0.3	1550.5	S/B ENG'S
100204	1541	+04:00	16 00.053S	057 00.005E	4331		226	0.7	175	0.8			1552.4	STOPPED ENG'S
100204	1544	+04:00	16 00.090S	057 00.018E	4343		204	0.5	178	0.8			1552.5	CHANGED ENG'S TO E/M
100204	1555	+04:00	16 00.228S	057 00.008E	4343	St.22	310	0.1	176	0.6			1552.7	CTD-CMS STARTED
100204	1614	+04:00	16 00.366S	056 59.936E	4342	St.22	310	0	193	0.2			1552.9	CTD-CMS DEEPEST
100204	1630	+04:00	16 00.449S	056 59.865E	4343	St.22	310	0	212	1.2			1553.1	CTD-CMS FINISHED
100204	1647	+04:00	16 00.608S	056 59.856E	4345	St.22	310	1.4	276	1.5			1553.4	IKMT NET STARTED
100204	1719	+04:00	15 59.718S	056 58.938E	4335	St.22	331	2.4	328	2.7	303	0.2	1554.7	IKMT NET DEEPEST
100204	1806	+04:00	15 58.333S	056 58.016E	4334	St.22	330	1.1	308	1.4			1556.4	IKMT NET FINISHED
100204	1822	+04:00	15 58.646S	056 58.296E	4332		139	3.2	141	3.4	148	5.1	1556.9	CHANGED ENG'S TO T/M
100204	1822	+04:00	15 58.658S	056 58.304E	4332		142	3.4	140	3.4	227	0.2	1556.9	SLOW AHEAD ENG'S
100204	1831	+04:00	15 59.911S	056 59.137E	4331		174	13.8	173	14.5	168	0.6	1558.5	S/CO ON 180°
100204	1833	+04:00	16 00.491S	056 59.160E	4334		179	16.3	177	16.4	242	0.1	1559.1	R/UP ENG'S
100204	1848	+04:00	16 04.492S	056 59.328E	4351		178	16.8	176	15.9	17	0.2	1563.1	SUNSET & PUT ON REGULATION LIGHTS
100204	2206	+04:00	16 58.590S	057 00.108E	6		183	16.5	182	16.1	52	0.5	1616.9	S/B ENG'S
100204	2217	+04:00	17 00.019S	057 00.010E	4250		297	1	241	0.8			1618.3	STOPPED ENG'S
100204	2219	+04:00	17 00.028S	057 00.004E	4251		297	0.6	188	1.1			1618.4	CHANGED ENG'S TO E/M
100204	2224	+04:00	16 59.997S	056 59.958E	4248	St.23	332	1.6	323	1.8			1618.5	IKMT NET STARTED
100204	2237	+04:00	16 59.522S	056 59.758E	4191	St.23	330	2.4	330	2.7	72	0.4	1619	IKMT NET DEEPEST
100204	2357	+04:00	16 56.645S	056 58.547E	3948	St.23	341	1.2	350	1.7	355	10.6	1622.2	IKMT NET FINISHED
100205	14	+04:00	16 56.900S	056 58.427E	3928		210	1.1	178	1.3			1622.7	CHANGED ENG'S TO E/M
100205	35	+04:00	17 00.067S	056 58.398E	3797		179	16.2	181	16.5	209	0.5	1625.9	R/UP ENG'S & S/CO ON 180°
100205	408	+04:00	17 58.459S	056 59.987E	4174		176	16.5	175	16.1	263	0.7	1684.4	S/B ENG'S
100205	420	+04:00	18 00.040S	056 59.933E	4177		228	0.5	165	1.1			1685.9	STOPPED ENG'S
100205	422	+04:00	18 00.059S	056 59.915E	4174		227	0.1	227	1.3			1685.9	CHANGED ENG'S TO E/M
100205	428	+04:00	18 00.053S	056 59.824E	4190	St.24	335	1.4	324	2			1686	IKMT NET STARTED
100205	456	+04:00	17 59.105S	056 59.048E	4190	St.24	335	2.4	330	3.2	274	0.7	1687.3	IKMT NET DEEPEST
100205	539	+04:00	17 57.858S	056 57.958E	4190	St.24	336	1.4	295	2.1			1689	IKMT NET FINISHED
100205	552	+04:00	17 57.874S	056 58.148E	4211		93	3.2	102	2.7	117	5.4	1689.3	CHANGED ENG'S TO T/M
100205	553	+04:00	17 57.878S	056 58.175E	4210		91	3.9	96	3.1	239	0.8	1689.3	SLOW AHEAD ENG'S
100205	553	+04:00	17 57.880S	056 58.187E	4210		91	4.3	96	3.5	238	0.8	1689.3	S/CO ON 090°
100205	600	+04:00	17 57.966S	056 59.215E	4205		92	12.7	94	12	234	0.5	1690.3	SUNRISE & TURNED OFF REGULATION LIGHTS
100205	603	+04:00	17 58.007S	057 00.077E	4205		92	16.5	94	15.4	262	0.9	1691.2	R/UP ENG'S
100205	936	+04:00	18 00.008S	057 58.526E	3939		90	16.6	90	16	293	0.2	1746.8	S/B ENG'S
100205	946	+04:00	17 59.930S	058 00.011E	3939		350	0.7	36	0.7			1748.3	STOPPED ENG'S
100205	948	+04:00	17 59.923S	058 00.019E	3939		350	0.4	197	0.5			1748.3	CHANGED ENG'S TO E/M
100205	955	+04:00	17 59.885S	058 00.032E	3939	St.25	340	0.4	13	0.8			1748.4	CTD-CMS STARTED
100205	1015	+04:00	17 59.858S	057 59.941E	3939	St.25	314	0.1	225	0.8			1748.7	CTD-CMS DEEPEST
100205	1042	+04:00	17 59.940S	057 59.772E	3939	St.25	319	0.6	249	0.8			1749	CTD-CMS FINISHED
100205	1053	+04:00	17 59.559S	057 59.690E	3985	St.25	355	2.4	351	2.8	338	0.4	1749.5	IKMT NET STARTED
100205	1128	+04:00	17 58.085S	057 59.450E	3994	St.25	351	2.4	351	2.8	342	0.5	1751	IKMT NET DEEPEST
100205	1228	+04:00	17 55.273S	057 59.045E	4034	St.25	350	1.3	13	2.2			1753.9	IKMT NET FINISHED
100205	1242	+04:00	17 54.644S	057 59.074E	4040		354	2.3	356	2.9	63	0.3	1754.5	CHANGED ENG'S TO T/M
100205	1242	+04:00	17 54.643S	057 59.074E	4040		355	2.3	350	2.1	63	0.3	1754.5	SLOW AHEAD ENG'S
100205	1242	+04:00	17 54.633S	057 59.075E	4040		355	2.5	358	2.4	58	0.4	1754.5	S/CO ON 000°
100205	1302	+04:00	17 51.194S	057 59.230E	4082		2	16.2	3	16.5	18	0.2	1757.9	R/UP ENG'S
100205	1606	+04:00	17 01.613S	058 00.002E	3428		359	16.5	358	16.4	117	0.3	1807.4	S/B ENG'S
100205	1618	+04:00	17 00.042S	058 00.030E	3604		346	0.8	103	1.9			1809	STOPPED ENG'S
100205	1627	+04:00	17 00.049S	058 00.140E	3558	St.26	269	0.2	150	1.6			1809.1	CTD STARTED
100205	1644	+04:00	17 00.161S	058 00.133E	3511	St.26	299	0.6	300	0.5			1809.3	CTD-CMS DEEPEST

KH-09-5 Leg5

Date (YYMMDD)	Time (hhmm)	Time Difference between Ship Time and UTC	Latitude	Longitude	Water Depth (m)	Station Name	Heading (deg.)	Log Speed (knot)	System Course (deg.)	System Speed (knot)	Current Direction (deg.)	Current Speed (knot)	Distance (mile)	Comment
100205	1656	+04:00	17 00.177S	058 00.103E	3507	St.26	290	0.4	161	0.5			1809.4	CTD-CMS FINISHED
100205	1703	+04:00	17 00.169S	058 00.065E	3505	St.26	300	1.8	290	1.7			1809.5	IKMT NET STARTED
100205	1733	+04:00	16 59.604S	057 58.969E	3497	St.26	300	2.3	308	2.6	266	0.1	1810.8	IKMT NET DEEPEST
100205	1825	+04:00	16 58.646S	057 57.285E	3589	St.26	310	1.4	308	1.6			1812.8	IKMT NET FINISHED
100205	1838	+04:00	16 58.205S	057 57.291E	3597		7	3.1	4	3.6	22	0.4	1813.3	CHANGED ENG'S TO T/M
100205	1839	+04:00	16 58.126S	057 57.303E	3597		6	4.8	9	5.2	24	0.4	1813.3	SLOW AHEAD ENG'S
100205	1839	+04:00	16 58.108S	057 57.305E	3598		6	5.2	358	5.5	14	0.7	1813.3	S/CO ON 000°
100205	1846	+04:00	16 57.001S	057 57.424E	3567		4	12.9	8	12.4	152	0.2	1814.5	SUNSET & PUT ON REGULATION LIGHTS
100205	1851	+04:00	16 55.753S	057 57.546E	3672		5	16.8	6	16.1	166	0.5	1815.8	R/UP ENG'S
100205	2212	+04:00	16 01.501S	058 00.072E	4072		358	16.3	3	15.3	144	1.1	1869.8	S/B ENG'S
100205	2223	+04:00	16 00.132S	058 00.141E	4077		308	0.7	91	0.8			1871.1	STOPPED ENG'S
100205	2225	+04:00	16 00.149S	058 00.161E	4077		288	0.4	139	1			1871.2	CHANGED ENG'S TO E/M
100205	2233	+04:00	16 00.249S	058 00.235E	4076	St.27	315	0.1	142	1.3			1871.3	CTD-CMS STARTED
100205	2252	+04:00	16 00.402S	058 00.373E	4075	St.27	324	1.1	341	0.6			1871.6	CTD-CMS DEEPEST
100205	2317	+04:00	16 00.350S	058 00.502E	4075	St.27	325	0.4	113	0.9			1871.9	CTD-CMS FINISHED
100205	2328	+04:00	16 00.321S	058 00.554E	4076	St.27	320	2.8	335	2.4	120	0.5	1872.1	IKMT NET STARTED
100205	2340	+04:00	15 59.989S	058 00.398E	4078	St.27	320	2.4	341	2	341	7	1872.5	IKMT NET DEEPEST
100206	55	+04:00	15 58.274S	057 59.516E	4089	St.27	330	1.3	33	0.7			1874.6	IKMT NET FINISHED
100206	109	+04:00	15 57.797S	057 59.749E	4093		359	2.5	30	2.9	101	1.3	1875.1	CHANGED ENG'S TO T/M
100206	109	+04:00	15 57.796S	057 59.750E	4093		358	2.6	33	2.5	103	1.3	1875.1	SLOW AHEAD ENG'S
100206	131	+04:00	15 54.062S	058 00.160E	4130		356	16.8	358	16.3	128	1	1878.8	R/UP ENG'S
100206	131	+04:00	15 54.053S	058 00.160E	4130		357	16.9	359	16.1	128	1	1878.8	S/CO ON 000°
100206	443	+04:00	15 01.600S	057 59.968E	4152		2	16.8	1	16.6	192	0.2	1931	S/B ENG'S
100206	455	+04:00	14 59.947S	058 00.004E	4162		354	0.9	44	0.8			1932.7	STOPPED ENG'S
100206	456	+04:00	14 59.932S	058 00.019E	4162		21	0.2	58	1.2			1932.7	CHANGED ENG'S TO E/M
100206	502	+04:00	14 59.917S	058 00.052E	4162	St.28	300	0.2	31	0.7			1932.8	CTD STARTED
100206	519	+04:00	14 59.851S	057 59.952E	4164	St.28	300	0.5	330	0.7			1933	CTD DEEPEST
100206	533	+04:00	14 59.784S	057 59.874E	4165	St.28	300	0.4	337	0.6			1933.2	CTD FINISHED
100206	540	+04:00	14 59.693S	057 59.820E	4165	St.28	326	1.6	346	2.4	329	12	1933.3	IKMT NET STARTED
100206	600	+04:00	14 58.865S	057 59.407E	4171	St.28	325	2.5	330	2.9	20	0.7	1934.2	SUNSET & PUT ON REGULATION LIGHTS
100206	611	+04:00	14 58.372S	057 59.180E	4176	St.28	326	2.4	325	2.7	37	0.6	1934.8	IKMT NET DEEPEST
100206	703	+04:00	14 56.548S	057 58.577E	4187	St.28	326	1.3	351	1.7			1936.8	IKMT NET FINISHED
100206	716	+04:00	14 56.012S	057 58.689E	4188	St.28	6	3.2	15	3.7	42	1	1937.3	CHANGED ENG'S TO T/M
100206	730	+04:00	14 53.493S	057 58.888E	4198		2	16.5	3	16.9	16	0.3	1939.8	R/UP ENG'S & S/CO ON <000>
100206	1036	+04:00	14 01.266S	058 00.056E	4146		358	16.5	2	16.2	121	0.8	1991.8	S/B ENG'S
100206	1046	+04:00	13 59.968S	058 00.049E	4145		274	0.7	4	0.5			1993.1	STOPPED ENG'S
100206	1047	+04:00	13 59.964S	058 00.062E	4144		260	0.4	42	0.5			1993.2	CHANGED ENG'S TO E/M
100206	1052	+04:00	13 59.959S	058 00.084E	4144	St.29	270	0.4	125	0.6			1993.2	CTD STARTED
100206	1109	+04:00	13 59.976S	058 00.149E	4146	St.29	259	0.4	144	0.6			1993.3	CTD DEEPEST
100206	1124	+04:00	14 00.003S	058 00.211E	4145	St.29	259	0.5	147	0.6			1993.5	CTD FINISHED
100206	1134	+04:00	13 59.962S	058 00.247E	4143	St.29	306	2.1	335	2.1	83	12	1993.7	IKMT NET STARTED
100206	1159	+04:00	13 59.271S	057 59.533E	4153	St.29	299	2.3	310	2.2			1994.7	IKMT NET DEEPEST
100206	1245	+04:00	13 58.271S	057 58.485E	4167	St.29	290	1.6	280	1.5			1996.2	IKMT NET FINISHED
100206	1257	+04:00	13 57.635S	057 58.551E	4170		2	2.8	15	3.5	52	0.8	1996.9	CHANGED ENG'S TO T/M
100206	1257	+04:00	13 57.634S	057 58.551E	4170		2	2.8	15	3.5	52	0.8	1996.9	SLOW AHEAD ENG'S
100206	1320	+04:00	13 53.317S	057 59.026E	3788		2	16.8	3	16.7	89	0.8	2001.2	R/UP ENG'S
100206	1320	+04:00	13 53.303S	057 59.027E	3790		3	16.9	6	16.8	89	0.8	2001.2	S/CO ON 000°
100206	1627	+04:00	13 01.630S	057 59.997E	4280		2	16.8	359	16.4	220	0.5	2052.8	S/B ENG'S
100206	1639	+04:00	13 00.009S	057 59.970E	4282		350	0.6	302	1.1			2054.4	STOPPED ENG'S
100206	1641	+04:00	12 59.991S	057 59.958E	4281		348	0.5	1	0.7			2054.4	CHANGED ENG'S TO E/M
100206	1645	+04:00	12 59.971S	057 59.927E	4282	St.30	300	0.3	300	0.4			2054.5	CTD-CMS STARTED
100206	1702	+04:00	13 00.005S	057 59.862E	4282	St.30	249	0	224	0.4			2054.7	CTD-CMS DEEPEST
100206	1721	+04:00	13 00.074S	057 59.844E	4285	St.30	249	0	295	0.7			2054.9	CTD-CMS FINISHED
100206	1726	+04:00	13 00.108S	057 59.707E	4282	St.30	251	2.2	248	2.7	296	0.3	2055.1	IKMT NET STARTED
100206	1759	+04:00	13 00.458S	057 58.189E	4284	St.30	250	2.5	255	2.9	270	0.7	2056.7	IKMT NET DEEPEST
100206	1841	+04:00	13 00.773S	057 56.809E	4286	St.30	250	1.6	255	1.9			2058.1	SUNSET & PUT ON REGULATION LIGHTS
100206	1856	+04:00	13 00.932S	057 56.280E	4287	St.30	250	1.5	238	2.3	266	0.8	2058.7	IKMT NET FINISHED
100206	1910	+04:00	13 00.977S	057 56.453E	4284	St.30	92	3.3	94	2.7	264	0.5	2059.1	CHANGED ENG'S TO T/M
100206	1924	+04:00	13 00.863S	057 58.804E	4283		88	16.6	87	16.1	271	0.8	2061.4	R/UP ENG'S & S/CO ON <090>
100206	2307	+04:00	12 59.798S	058 58.702E	4023		93	16.5	89	15.1	305	1.3	2119.9	S/B ENG'S
100206	2317	+04:00	12 59.833S	058 59.812E	4021		156	1.1	44	0.6	215	0.8	2121	STOPPED ENG'S
100206	2319	+04:00	12 59.838S	058 59.794E	4020		178	0.9	84	0.3			2121	CHANGED ENG'S TO E/M
100206	2323	+04:00	12 59.879S	058 59.805E	4020	St.31	125	3	146	2			2121.1	IKMT NET STARTED
100206	2335	+04:00	13 00.088S	059 00.027E	4020	St.31	136	2.8	178	2			2121.4	IKMT NET DEEPEST
100207	48	+04:00	13 01.583S	059 00.750E	4021	St.31	139	1.6	168	0.7			2123.3	IKMT NET FINISHED
100207	100	+04:00	13 01.441S	059 01.138E	4019		82	3.1	72	2.3	306	0.9	2123.7	CHANGED ENG'S TO E/M
100207	100	+04:00	13 01.439S	059 01.142E	4019		82	3.2	64	2.6	304	0.9	2123.7	SLOW AHEAD ENG'S
100207	120	+04:00	13 00.889S	059 04.782E	4001		84	16.2	83	16.2	311	0.8	2127.2	R/UP ENG'S
100207	120	+04:00	13 00.887S	059 04.791E	4001		84	16.2	81	15.5	311	0.8	2127.2	S/CO ON 090°
100207	441	+04:00	13 00.025S	059 58.666E	3705		90	16.5	91	15.5	246	1.1	2180	S/B ENG'S
100207	452	+04:00	13 00.043S	059 59.995E	3694		88	0.8	314	0.7			2181.3	STOPPED ENG'S
100207	455	+04:00	13 00.057S	059 59.982E	3695		78	0.5	213	0.4			2181.3	CHANGED ENG'S TO E/M
100207	501	+04:00	13 00.139S	059 59.977E	3691	St.32	156	1.9	159	2	190	6.8	2181.4	IKMT NET STARTED
100207	530	+04:00	13 01.403S	060 00.295E	3649	St.32	155	2.2	143	2.6	216	0.4	2182.8	IKMT NET DEEPEST
100207	555	+04:00	13 02.253S	060 00.586E	3610	St.32	154	2.1	151	2.4	171	0.4	2183.8	SUNRISE & TURNED OFF REGULATION LIGHTS
100207	622	+04:00	13 03.234S	060 00.967E	3618	St.32	155	1.6	161	2			2184.8	IKMT NET FINISHED
100207	636	+04:00	13 03.376S	060 01.421E	3614	St.32	85	3.4	81	3.7	143	0.4	2185.3	CHANGED ENG'S TO T/M
100207	636	+04:00	13 03.377S	060 01.455E	3614		85	3.8	80	3.9	152	0.5	2185.3	SLOW AHEAD ENG'S
100207	648	+04:00	13 03.204S	060 03.685E	3513		80	16.1	82	16.4	140	0.5	2187.4	R/UP ENG'S
100207	1210	+04:00	12 59.928S	061 28.322E	2652		90	16.3	87	15.5	315	1	2270.3	S/B ENG'S
100207	1222	+04:00	12 59.857S	061 29.997E	2750		115	0.8	215	0.6			2272	STOPPED ENG'S
100207	1226	+04:00	12 59.831S	061 29.987E	2750		128	0.6	6	1.1			2272	CHANGED ENG'S TO E/M
100207	1230	+04:00	12 59.781S	061 29.945E	2750	St.33	110	0.4	326	1.1			2272.1	CTD-CMS STARTED
100207	1249	+04:00	12 59.519S	061 29.776E	2743	St.33	91	1.3	22	1.3			2272.5	CTD-CMS DEEPEST
100207	1309	+04:00	12 59.308S	061 29.754E	2742	St.33	69	0.6	284	0.5			2272.8	CTD-CMS FINISHED
100207	1316	+04:00	12 59.231S	061 29.676E	2741	St.33	45	1.2	356	1.5			2272.9	IKMT NET STARTED
100207	1354	+04:00	12 58.085S	061 30.329E	2810	St.33	56	2.3	58	2	2	0.6	2274.2	IKMT NET DEEPEST
100207	1446	+04:00	12 56.992S	061 31.245E	2849	St.33	56	1.8	27	1.3			2275.7	IKMT NET FINISHED
100207	1502	+04:00	12 57.051S	061 30.801E	2834		236	3	248	3.5	292	0.6	2276.3	CHANGED ENG'S TO T/M
100207	1502	+04:00	12 57.052S	061 30.799E	2834		236	3	251	3.5	292	0.6	2276.3	SLOW AHEAD ENG'S
100207	1526	+04:00	12 59.336S	061 26.408E	2613		239	16.3	244	16.7	291	0.9	2281.1	R/UP ENG'S
100207	1526	+04:00	12 59.343S	061 26.396E	2612		239	16.3	240	17.1	291	0.9	2281.1	S/CO ON 248°
100207	1830	+04:00	13 20.678S	060 38.060E	254		246	16.8	248	16.9	319	0.9	2332.9	SUNSET & PUT ON REGULATION LIGHTS
100207	1955	+04:00	13 30.109S	060 15.017E	3170		244	16.8	244	17.4	200	0.6	2357.4	A/CO TO 219°
100207	2139	+04:00	13 52.362S	059 56.391E	3855		219	16.8	219	16.3	204	0.3	2386	S/B ENG'S
100207	2227	+04:00	14 00.032S	059 49.970E	3924		158	1.1	179	0.7			2395.9	STOPPED ENG'S
100207	2229	+04:00	14 00.054S	059 49.968E	3925		140	0.8	87	0.6			2395.9	CHANGED ENG'S TO E/M
100207	2233	+04:00	14 00.133S	059 50.000E	3925	St.34	160	1.9	197	3	172	7.5	2396	IKMT NET STARTED
100207	2250	+04:00	14 00.804S	059 50.160E	3926	St.34	161	2.2	165	2.5	250	0.4	2396.8	IKMT NET DEEPEST
100208	14	+04:00	14 03.889S	059 51.802E	3924	St.34	154	1.4	146	1.5			2400.4	IKMT NET FINISHED
100208	28	+04:00	14 03.973S	059 51.307E	3926		270	2.8	266	2.5	358	0.3	2401	CHANGED ENG'S TO T/M
100208	28	+04:00	14 03.973S	059 51.306E	3926		270	2.8	264	2.6	2	0.3	2401	SLOW AHEAD ENG'S
100208	50	+04:00	14 03.642S	059 47.373E	3924		276	16.5	275	16.3	20	0.1	2404.7	R/UP ENG'S
100208	50	+04:00	14 03.641S	059 47.364E	3924		276	16.8	277	16.6	20	0.1	2404.7	S/CO ON 270°
100208	334	+04:00	13 59.897S	059 01.752E	4013		270	16.8	270	16	120	0.5	2449.3	S/B ENG'S
100208	348	+04:00	13 59.862S	058 59.778E	4022		263	1	277	1.3			2451.2	STOPPED ENG'S
100208	352	+04:00	13 59.856S	058 59.774E	4022		184	0.6	134	0.7			2451.3	CHANGED ENG'S TO E/M

KH-09-5 Leg5

Date (YYMMDD)	Time (hhmm)	Time Difference between Ship Time and UTC	Latitude	Longitude	Water Depth (m)	Station Name	Heading (deg.)	Log Speed (knot)	System Course (deg.)	System Speed (knot)	Current Direction (deg.)	Current Speed (knot)	Distance (mile)	Comment
100208	354	+04:00	13 59.889S	058 59.815E	4022	St.35	139	1.7	135	2.5	330	0.4	2451.4	IKMT NET STARTED
100208	409	+04:00	14 00.383S	059 00.328E	4018	St.35	140	2.5	150	2.8	17	0.4	2452.1	IKMT NET DEEPEST
100208	528	+04:00	14 02.741S	059 02.135E	4009	St.35	140	1.3	152	2	143	6.3	2455.1	IKMT NET FINISHED
100208	537	+04:00	14 02.737S	059 02.242E	4010	St.35	109	0.2	69	0.7			2455.3	CTD-CMS STARTED
100208	555	+04:00	14 02.590S	059 02.413E	4008	St.35	130	0.4	37	1.1			2455.5	CTD-CMS DEEPEST
100208	558	+04:00	14 02.578S	059 02.430E	4008	St.35	130	0.2	70	0.1			2455.6	SUNRISE & TURNED OFF REGULATION LIGHTS
100208	614	+04:00	14 02.531S	059 02.552E	4008	St.35	119	0.2	60	0.6			2455.8	CTD-CMS FINISHED
100208	625	+04:00	14 02.480S	059 02.685E	4008	St.35	120	0.4	70	0.7			2455.9	FREE FALL STARTED
100208	731	+04:00	14 02.299S	059 03.085E	4006	St.35	126	0.1	196	0.9			2456.8	NO2.WINCHI WIRE DEEPEST
100208	924	+04:00	14 02.281S	059 03.103E	4007	St.35	120	0.5	51	0.7			2457.8	FREE FALL FINISHED
100208	934	+04:00	14 02.564S	059 03.337E	4006		145	2.3	149	1.9	238	0.3	2458.1	CHANGED ENG'S TO T/M
100208	935	+04:00	14 02.601S	059 03.360E	4006		143	2.9	153	2.8	219	0.3	2458.2	SLOW AHEAD ENG'S
100208	936	+04:00	14 02.607S	059 03.364E	4006		142	3	149	2.9	260	0.3	2458.2	S/CO ON 141°
100208	1000	+04:00	14 06.519S	059 06.193E	4000		144	16.5	145	15.9	314	0.4	2463	R/UP ENG'S
100208	1402	+04:00	14 58.632S	059 48.844E	2092		139	16.6	141	16.7	203	0.7	2529.3	S/B ENG'S
100208	1414	+04:00	15 00.143S	059 50.004E	1175		140	0.7	198	2	195	2.7	2531.1	STOPPED ENG'S
100208	1417	+04:00	15 00.215S	059 49.979E	1181		166	0.7	215	1.8			2531.2	CHANGED ENG'S TO E/M
100208	1422	+04:00	15 00.335S	059 49.949E	1185	St.36	110	0.9	163	1.6			2531.3	IKMT NET STARTED
100208	1454	+04:00	15 01.389S	059 50.827E	707	St.36	149	2	174	3	222	0.8	2532.8	IKMT NET DEEPEST
100208	1547	+04:00	15 03.202S	059 51.129E	872	St.36	141	0.5	115	0.8			2534.7	IKMT NET FINISHED
100208	1601	+04:00	15 03.356S	059 50.653E	746		267	3.7	266	3.9	208	0.5	2535.3	CHANGED ENG'S TO T/M
100208	1601	+04:00	15 03.356S	059 50.652E	746		267	3.9	268	4	208	0.5	2535.3	SLOW AHEAD ENG'S
100208	1615	+04:00	15 03.430S	059 47.804E	1107		272	16.8	269	16.5	193	0.6	2538.1	R/UP ENG'S
100208	1838	+04:00	15 00.474S	059 07.272E	3954		276	16.6	273	16.6	184	0.8	2577.5	SUNSET & PUT ON REGULATION LIGHTS
100208	1857	+04:00	15 00.020S	059 01.796E	3947		275	16.6	271	16.4	199	0.6	2582.9	S/B ENG'S
100208	1910	+04:00	15 00.049S	058 59.950E	3950		316	0.7	266	0.8			2584.6	STOPPED ENG'S
100208	1912	+04:00	15 00.056S	058 59.915E	3950		332	0.8	334	0.6			2584.6	CHANGED ENG'S TO E/M
100208	1917	+04:00	15 00.074S	058 59.895E	3949	St.37	100	1.4	104	1.2			2584.7	IKMT NET STARTED
100208	1944	+04:00	15 00.406S	059 00.789E	3942	St.37	101	2.5	114	2.2	232	0.4	2585.7	IKMT NET DEEPEST
100208	2026	+04:00	15 00.855S	059 01.869E	3937	St.37	100	1.2	110	1.2			2586.9	IKMT NET FINISHED
100208	2037	+04:00	15 01.324S	059 01.816E	3949		184	2.8	192	3.3	247	0.8	2587.4	CHANGED ENG'S TO T/M
100208	2037	+04:00	15 01.327S	059 01.815E	3948		185	2.8	197	3.1	248	0.8	2587.4	SLOW AHEAD ENG'S
100208	2037	+04:00	15 01.336S	059 01.813E	3948		185	2.8	195	3.3	240	0.8	2587.4	S/CO ON 180°
100208	2100	+04:00	15 05.735S	059 01.287E	3934		184	16.5	184	16.8	237	0.6	2591.8	R/UP ENG'S
100209	9	+04:00	15 58.333S	058 59.765E	2522		180	16.3	181	16.5	273	0.6	2644.5	S/B ENG'S
100209	20	+04:00	16 00.142S	058 59.822E	2238		127	1	193	1.2			2646.2	STOPPED ENG'S
100209	23	+04:00	16 00.190S	058 59.813E	2211		122	0.4	201	1.5			2646.2	CHANGED ENG'S TO E/M
100209	28	+04:00	16 00.263S	058 59.791E	2207	St.38	120	0.4	211	0.8			2646.3	CTD-CMS STARTED
100209	48	+04:00	16 00.369S	058 59.709E	2175	St.38	90	0.8	199	0.2			2646.5	CTD-CMS DEEPEST
100209	108	+04:00	16 00.433S	058 59.649E	2154	St.38	92	0.2	242	0.8			2646.7	CTD-CMS FINISHED
100209	116	+04:00	16 00.499S	058 59.528E	2137	St.38	100	0.5	138	1.4			2646.9	IKMT NET STARTED
100209	131	+04:00	16 00.770S	058 59.989E	2119	St.38	101	2.4	103	2	173	1.1	2647.4	IKMT NET DEEPEST
100209	250	+04:00	16 01.850S	059 02.254E	1801	St.38	100	1.8	120	1.7			2650	IKMT NET FINISHED
100209	301	+04:00	16 02.360S	059 02.209E	1782		187	1.3	204	1.8	208	1.2	2650.5	CHANGED ENG'S TO T/M
100209	301	+04:00	16 02.363S	059 02.208E	1784		187	1.2	193	2.1	209	1.4	2650.5	SLOW AHEAD ENG'S
100209	325	+04:00	16 06.909S	059 01.697E	1591		185	16.8	185	16.9	227	0.4	2655.1	R/UP ENG'S
100209	325	+04:00	16 06.914S	059 01.696E	1591		185	16.6	186	16.7	227	0.4	2655.1	S/CO ON 180°
100209	555	+04:00	16 49.049S	058 59.812E	1818		187	16.9	187	16.6	150	0.1	2697.1	SUNRISE & TURNED OFF REGULATION LIGHTS
100209	627	+04:00	16 58.033S	058 59.085E	1406		182	16.8	181	16.6	22	0.2	2706.2	S/B ENG'S
100209	640	+04:00	17 00.081S	058 59.058E	1534		185	0.8	171	0.8			2708.2	STOPPED ENG'S
100209	645	+04:00	17 00.125S	058 59.055E	1538		120	0.8	122	1.2			2708.3	CHANGED ENG'S TO E/M
100209	647	+04:00	17 00.132S	058 59.115E	1520	St.39	90	2.1	94	2.2	102	0.8	2708.3	IKMT NET STARTED
100209	713	+04:00	17 00.119S	059 00.186E	1280	St.39	92	1.9	92	2	78	0.8	2709.4	IKMT NET DEEPEST
100209	800	+04:00	16 59.956S	059 01.750E	1052	St.39	90	1.2	103	1.3			2710.9	IKMT NET FINISHED
100209	809	+04:00	17 00.236S	059 01.821E	1010		185	2.7	198	3	256	0.4	2711.4	CHANGED ENG'S TO T/M
100209	809	+04:00	17 00.239S	059 01.820E	1016		185	2.9	188	3.2	259	0.5	2711.4	SLOW AHEAD ENG'S
100209	809	+04:00	17 00.245S	059 01.819E	1022		185	3	192	3.3	252	0.4	2711.4	S/CO ON 180°
100209	830	+04:00	17 03.702S	059 01.323E	1026		185	16.6	187	16.3	317	0.6	2714.7	R/UP ENG'S
100209	1151	+04:00	17 58.234S	058 59.942E	2220		177	16.5	179	16.6	275	0.8	2769.3	S/B ENG'S
100209	1201	+04:00	17 59.973S	058 59.929E	2446		158	1.8	189	2	265	0.9	2771.1	STOPPED ENG'S
100209	1205	+04:00	18 00.014S	058 59.882E	2447		162	0.2	144	0.8			2771.2	CHANGED ENG'S TO E/M
100209	1210	+04:00	18 00.013S	058 59.805E	2456	St.40	90	0.1	280	1.6			2771.3	CTD-CMS STARTED
100209	1231	+04:00	17 59.958S	058 59.631E	2480	St.40	71	0.9	346	1.2			2771.6	CTD-CMS DEEPEST
100209	1251	+04:00	17 59.862S	058 59.393E	2489	St.40	121	0.2	251	1.1			2772	CTD-CMS FINISHED
100209	1257	+04:00	17 59.935S	058 59.376E	2510	St.40	136	1.4	171	1.6			2772	IKMT NET STARTED
100209	1331	+04:00	18 01.067S	059 00.046E	2482	St.40	134	2.5	169	2.4	211	0.7	2773.4	IKMT NET DEEPEST
100209	1426	+04:00	18 02.703S	059 00.514E	2582	St.40	145	1.6	162	1.8			2775.4	IKMT NET FINISHED
100209	1457	+04:00	18 03.459S	059 00.665E	2599		106	0.5	330	1.3			2776.3	CHANGED ENG'S TO S/M
100209	1457	+04:00	18 03.460S	059 00.664E	2566		105	0.5	325	1			2776.3	SLOW AHEAD ENG'S
100209	1530	+04:00	18 06.003S	058 57.141E	3142		231	9.4	232	10.4	265	0.8	2780.6	S/CO ON 224°
100209	1539	+04:00	18 06.891S	058 55.903E	3226		231	8.9	233	9.7	258	0.8	2782.1	PUT ON AIS
100209	1844	+04:00	18 26.027S	058 33.912E	2605		217	9.1	222	9.1	302	0.7	2810.7	SUNSET & PUT ON REGULATION LIGHTS
100210	403	+04:00	19 29.819S	057 30.093E	697		209	8.2	218	9.1	279	0.7	2899	A/CO TO 184°
100210	559	+04:00	19 47.486S	057 28.673E	2359		176	9.4	182	9.6	250	1	2916.9	SUNRISE & TURNED OFF REGULATION LIGHTS
100210	758	+04:00	20 07.791S	057 27.481E	1233		163	2.4	170	2.4	283	0.3	2937.2	STOPPED ENG'S

Date (YYMMDD)	Time (hhmm)	Time Difference between Ship Time and UTC	Latitude	Longitude	Water Depth (m)	Station Name	Heading (deg.)	Log Speed (knot)	System Course (deg.)	System Speed (knot)	Current Direction (deg.)	Current Speed (knot)	Distance (mile)	Comment
100214	1524	+04:00	20 09.350S	057 29.835E	1233		157	0.2	271	0			0.1	PILOT CAME ON BOARD
100214	1538	+04:00	20 09.350S	057 29.836E	1233		157	0.2	128	0.2			0.1	LET GO ALL LINES
100214	1554	+04:00	20 09.049S	057 29.380E	1233		306	5.3	305	4.7	130	0.4	0.6	PILOT LEFT HER
100214	1559	+04:00	20 08.777S	057 28.978E	1233		306	7.6	305	7.1	129	0.5	1.1	CHANGED ENG'S TO T/M
100214	1615	+04:00	20 05.762S	057 28.315E	1233		360	16.6	0	16.3	185	0.1	4.4	R/UP ENG'S
100214	1652	+04:00	19 56.561S	057 31.688E	1233		39	15.9	38	15.2	233	1.1	14.3	S/CO ON 040°
100214	1735	+04:00	19 48.080S	057 39.454E	1233		82	15.1	79	15.3	84	0.5	25.3	A/CO TO 079°
100214	1846	+04:00	19 44.577S	057 58.869E	1233		79	16.3	83	15.9	228	0.4	44.1	SUNSET & PUT ON REGULATION LIGHTS
100215	548	+04:00	19 11.609S	060 57.941E	1233		80	15.9	77	16.1	271	0.3	216.7	SUNRISE & TURNED OFF REGULATION LIGHTS
100215	1300	+04:00	18 50.834S	062 51.904E	1233		76	16.1	78	14.8	229	1.7	327.3	COM'CED LIFEBOAT STATION DRILL
100215	1320	+04:00	18 49.872S	062 56.919E	1233		78	16.2	79	15.1	238	1.4	332.1	FINISHED LIFEBOAT STATION DRILL
100215	1819	+04:00	18 35.561S	064 14.268E	1233		78	15.4	76	14.9	251	0.5	407.2	SUNSET & PUT ON REGULATION LIGHTS
100215	2100	+04:00	18 27.459S	064 57.310E	0		80	15.6	79	14.4	335	0.4	449	Put ships clocks ah'd 1 hour
100216	409	+05:00	18 09.275S	066 36.443E	0		78	16.1	79	16.4	190	0.2	545.2	CLEARED OUT EEZ OF MAURITIUS
100216	625	+05:00	18 02.475S	067 12.506E	0		79	16.2	79	15.7	266	0.9	580.1	SUNRISE & TURNED OFF REGULATION LIGHTS
100216	1852	+05:00	17 25.339S	070 32.670E	4110		80	15.6	83	15.2	265	0.6	774.8	SUNSET & PUT ON REGULATION LIGHTS
100217	0	+05:00	17 10.181S	071 54.200E	5098		79	16.2	82	15.3	259	0.8	854.1	S/B ENG'S
100217	15	+05:00	17 10.057S	071 55.832E	4822		183	1.1	217	1.5			856.1	CHANGED ENG'S TO E/M
100217	22	+05:00	17 10.146S	071 55.754E	4838	St1	130	0.6	190	1			856.3	CTD-CMS STARTED
100217	41	+05:00	17 10.145S	071 55.617E	4854	St1	100	0.7	184	1.2			856.5	CTD-CMS DEEPEST
100217	105	+05:00	17 10.080S	071 55.488E	4866	St1	120	0.1	271	0.6			856.9	CTD-CMS FINISHED
100217	112	+05:00	17 10.117S	071 55.437E	4864	St1	135	0.9	205	1.2			857	IKMT NET STARTED
100217	126	+05:00	17 10.519S	071 55.635E	4852	St1	134	2.6	143	2.2	263	0.7	857.6	IKMT NET DEEPEST
100217	245	+05:00	17 12.685S	071 57.054E	4573	St1	129	1.4	152	1.4			860.5	IKMT NET FINISHED
100217	254	+05:00	17 12.633S	071 57.134E	4564		66	3.1	64	2.9	344	3.2	860.7	CHANGED ENG'S TO T/M
100217	322	+05:00	17 10.722S	072 02.112E	4846		71	16.1	72	15.1	233	0.6	865.8	R/UP ENG'S
100217	322	+05:00	17 10.715S	072 02.133E	4828		71	16.1	72	16.1	227	0.6	865.8	S/CO ON 079°
100217	604	+05:00	17 00.919S	072 44.730E	3763		78	16.2	78	16.3	226	0.6	908	SUNRISE & TURNED OFF REGULATION LIGHTS
100217	1829	+05:00	16 24.202S	076 00.355E	5073		80	16.3	82	15	294	1.3	1098.7	SUNSET & PUT ON REGULATION LIGHTS
100217	1900	+05:00	16 22.693S	076 08.476E	4919		82	16.2	80	15	293	1.1	1106.9	S/B ENG'S
100217	1910	+05:00	16 22.478S	076 09.721E	4785		166	1.2	7	0.8			1108	STOPPED ENG'S
100217	1912	+05:00	16 22.453S	076 09.692E	4780		185	0.3	306	2			1108.1	CHANGED ENG'S TO E/M
100217	1923	+05:00	16 22.314S	076 09.511E	4796	St2	166	0.1	296	1.3			1108.3	CTD STARTED
100217	1942	+05:00	16 22.119S	076 09.308E	4872	St2	143	0.1	305	0.7			1108.7	CTD DEEPEST
100217	1956	+05:00	16 21.993S	076 09.270E	4812	St2	152	0.3	359	1.3			1108.9	CTD FINISHED
100217	2004	+05:00	16 22.040S	076 09.174E	4815	St2	180	2.8	192	3	275	1.1	1109.1	IKMT NET STARTED
100217	2019	+05:00	16 22.563S	076 08.988E	4999	St2	177	2.6	198	2.9	289	1	1109.7	IKMT NET DEEPEST
100217	2139	+05:00	16 24.684S	076 08.705E	4918	St2	166	2.2	201	2.7	226	1.6	1112.2	IKMT NET FINISHED
100217	2150	+05:00	16 24.647S	076 08.909E	4923		85	2.1	55	0.7			1112.5	CHANGED ENG'S TO T/M
100217	2151	+05:00	16 24.619S	076 08.929E	4925		76	2.6	46	2.7	7	3.5	1112.6	S/CO ON 079°
100217	2211	+05:00	16 23.623S	076 11.800E	4867		76	15.6	69	14.8	311	1.7	1115.5	R/UP ENG'S
100218	100	+05:00	16 13.863S	076 55.726E	4803		80	16.6	76	15.4	299	0.9	1158.9	PUT SHIP'S CLOCK AHEAD 1HOUR FOR SAT IN LONG090-
100218	202	+06:00	16 13.759S	076 56.292E	4809		82	16.2	81	15.2	301	0.9	1159.4	S/B ENG'S
100218	210	+06:00	16 13.520S	076 57.615E	4820		94	4.6	90	4.1	312	1.2	1160.8	CHANGED ENG'S TO S/M
100218	215	+06:00	16 13.529S	076 57.698E	4818	St3	181	0.5	269	0.7			1161	IKMT NET STARTED
100218	229	+06:00	16 13.911S	076 57.490E	4806	St3	181	2.3	225	3	276	1	1161.5	IKMT NET DEEPEST
100218	351	+06:00	16 16.676S	076 56.039E	4768	St3	181	0.8	252	1.4			1164.8	IKMT NET FINISHED
100218	400	+06:00	16 16.546S	076 56.342E	4752		78	5.9	57	5.9	317	1.1	1165.3	CHANGED ENG'S TO T/M
100218	400	+06:00	16 16.541S	076 56.354E	4750		79	6	61	5.4	320	1.1	1165.3	S/CO ON 079°
100218	420	+06:00	16 15.120S	076 59.814E	4792		71	16.3	70	15.8	304	1.2	1168.9	R/UP ENG'S
100218	646	+06:00	16 06.080S	077 37.332E	4874		81	16.3	78	15.2	293	0.9	1208.4	SUNRISE & TURNED OFF REGULATION LIGHTS
100218	1900	+06:00	15 29.273S	080 53.699E	5093		81	16.1	79	16	35	0.8	1399.1	S/B ENG'S
100218	1908	+06:00	15 29.030S	080 55.086E	5112		104	4.4	96	4.2	2	0.7	1400.5	SUNSET & PUT ON REGULATION LIGHTS
100218	1911	+06:00	15 29.063S	080 55.179E	5114		179	0.9	66	0.9			1400.6	STOPPED ENG'S
100218	1914	+06:00	15 29.022S	080 55.211E	5112		149	0.2	34	1.7			1400.6	CHANGED ENG'S TO E/M
100218	1918	+06:00	15 28.965S	080 55.240E	5112	St4	170	0.6	27	1.1			1400.7	CTD-CMS STARTED
100218	1937	+06:00	15 28.821S	080 55.351E	5082	St4	180	0.5	213	0.5			1401	CTD-CMS DEEPEST
100218	2004	+06:00	15 28.752S	080 55.443E	5110	St4	180	0.2	79	0.4			1401.3	CTD-CMS FINISHED
100218	2012	+06:00	15 28.813S	080 55.464E	5110	St4	180	2.4	172	2	76	0.2	1401.4	IKMT NET STARTED
100218	2029	+06:00	15 29.457S	080 55.492E	5115	St4	190	2.6	175	2.6	31	0.3	1402.1	IKMT NET DEEPEST
100218	2149	+06:00	15 31.779S	080 53.823E	5007	St4	205	2	230	2	240	3.2	1405.1	IKMT NET FINISHED
100218	2203	+06:00	15 31.797S	080 54.126E	5016		82	2.2	56	2.3	20	1.6	1405.7	CHANGED ENG'S TO T/M
100218	2204	+06:00	15 31.775S	080 54.168E	5014		77	3.2	70	3.2	335	0.8	1405.7	S/CO ON 079°
100218	2221	+06:00	15 30.929S	080 56.980E	4946		74	16.2	73	16.4	16	0.3	1408.6	R/UP ENG'S
100219	200	+06:00	15 17.648S	081 55.755E	4964		80	16.5	85	16.2	13	0.2	1467.1	S/B ENG'S
100219	208	+06:00	15 17.414S	081 57.072E	4984		93	4.1	84	4.3	295	0.5	1468.4	CHANGED ENG'S TO S/M
100219	213	+06:00	15 17.481S	081 57.147E	5010	St5	201	0.8	168	0.9			1468.5	IKMT NET STARTED
100219	230	+06:00	15 18.063S	081 56.833E	5134	St5	200	2.3	217	2.8	276	0.5	1469.2	IKMT NET DEEPEST
100219	344	+06:00	15 20.618S	081 55.244E	4726	St5	201	0.8	216	1.4			1472.5	IKMT NET FINISHED
100219	351	+06:00	15 20.632S	081 55.404E	4772		81	4.3	64	4.1	298	0.7	1472.8	CHANGED ENG'S TO T/M
100219	410	+06:00	15 19.355S	081 58.796E	5342		70	16.1	65	16.1	258	0.1	1476.4	R/UP ENG'S
100219	410	+06:00	15 19.353S	081 58.800E	5320		71	16.3	67	16.6	258	0.1	1476.4	S/CO ON 079°
100219	627	+06:00	15 10.248S	082 34.885E	5050		81	16.1	82	16	317	0.7	1512.5	SUNRISE & TURNED OFF REGULATION LIGHTS
100219	1846	+06:00	14 31.534S	086 00.510E	2710		80	15.9	78	16.3	27	0.7	1715.4	SUNSET & PUT ON REGULATION LIGHTS
100219	1900	+06:00	14 30.807S	086 04.313E	2646		80	16.1	79	15.9	16	0.9	1719	S/B ENG'S
100219	1912	+06:00	14 30.490S	086 05.909E	2553		206	0.6	128	2.1			1720.7	STOPPED ENG'S
100219	1915	+06:00	14 30.449S	086 05.933E	2554		208	0.3	23	1			1720.8	CHANGED ENG'S TO E/M
100219	1918	+06:00	14 30.403S	086 05.962E	2554	St6	203	0.1	359	1.6			1720.9	CTD STARTED
100219	1939	+06:00	14 30.301S	086 06.092E	2553	St6	196	0.9	113	1.1			1721.2	CTD DEEPEST
100219	1954	+06:00	14 30.238S	086 06.156E	2551	St6	196	0.5	344	0.7			1721.5	CTD FINISHED
100219	2002	+06:00	14 30.268S	086 06.154E	2551	St6	197	2.2	196	2.7			1721.7	IKMT NET STARTED
100219	2017	+06:00	14 30.651S	086 05.975E	2551	St6	205	2.2	225	1.6			1722.2	IKMT NET DEEPEST
100219	2129	+06:00	14 32.430S	086 04.855E	2630	St6	204	1.7	211	1.4			1724.6	IKMT NET FINISHED
100219	2141	+06:00	14 32.283S	086 05.306E	2580		79	2.6	50	3	353	1.2	1725.3	CHANGED ENG'S TO T/M
100219	2151	+06:00	14 31.857S	086 06.288E	2558		75	9.6	69	9.8	339	0.8	1726.3	S/CO ON 079°
100219	2202	+06:00	14 30.980S	086 08.797E	2460		76	15.6	74	16.5	345	0.8	1728.9	R/UP ENG'S
100220	200	+06:00	14 17.598S	087 14.217E	2541		82	16.3	79	16.7	11	0.8	1793.9	S/B ENG'S
100220	207	+06:00	14 17.335S	087 15.550E	2624		90	4.8	81	4.8	8	0.8	1795.3	CHANGED ENG'S TO S/M
100220	211	+06:00	14 17.342S	087 15.699E	2632	St7	191	1	94	0.4			1795.5	IKMT NET STARTED
100220	227	+06:00	14 17.692S	087 15.737E	2609	St7	190	2.5	186	1.7			1795.9	IKMT NET DEEPEST
100220	338	+06:00	14 18.425S	087 17.064E	2573	St7	85	1.6	66	2.1			1798	IKMT NET FINISHED
100220	345	+06:00	14 18.197S	087 17.436E	2628		65	5.6	58	5.7	353	0.7	1798.4	CHANGED ENG'S TO T/M
100220	400	+06:00	14 16.818S	087 20.087E	2800		66	15.8	65	16.7	356	0.9	1801.5	R/UP ENG'S
100220	400	+06:00	14 16.811S	087 20.100E	2800		67	15.8	61	17.1	356	0.9	1801.5	S/CO ON 079°
100220	500	+06:00	14 13.327S	087 36.183E	3402		83	16.1	80	15.8	344	1.1	1817.6	PUT SHIP'S CLOCKS AHD 1 HR (UTC+7)
100220	707	+07:00	14 09.947S	087 54.616E	3666		81	16.3	77	16.4	331	1.2	1835.8	SUNRISE & TURNED OFF REGULATION LIGHTS
100220	1900	+07:00	13 33.322S	091 09.568E	5119		79	16.1	80	16.7	146	0.3	2029	S/B ENG'S
100220	1911	+07:00	13 33.000S	091 11.097E	5205		359	0.5	123	1.8			2030.7	STOPPED ENG'S
100220	1913	+07:00	13 33.008S	091 11.122E	5216		4	0.3	104	0.6			2030.7	CHANGED ENG'S TO E/M
100220	1920	+07:00	13 33.038S	091 11.212E	5214	St8	350	0.2	101	0.8			2030.9	CTD-CMS STARTED
100220	1923	+07:00	13 33.037S	091 11.236E	5217	St8	350	0.4	115	0.4			2030.9	SUNSET & PUT ON REGULATION LIGHTS
100220	1940	+07:00	13 33.165S	091 11.287E	5213	St8	299	0.1	180	0.7			2031.3	CTD-CMS DEEPEST
100220	2007	+07:00	13 33.350S	091 11.241E	5212	St8	309	0.3	104	0.8			2031.7	CTD-CMS FINISHED
100220	2016	+07:00	13 33.376S	091 11.256E	5138	St8	322	2.4	324	1.9	63	0.1	2031.9	IKMT NET STARTED
100220	2031	+07:00	13 32.907S	091 10.931E	5171	St8	320	2.5	314	2.8	130	0.5	2032.6	IKMT NET DEEPEST
100220	2148	+07:00	13 30.919S	091 09.195E	5175	St8	322	1.9	312	1.9			2035.3	IKMT NET FINISHED
100220	2159	+07:00	13 30.745S	091 09.621E	5014		68	2.5	80	2.5	140	0.9	2035.9	CHANGED ENG'S TO T/M

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Date (YYMMDD)	Time (hhmm)	Time Difference between Ship Time and UTC	Latitude	Longitude	Water Depth (m)	Station Name	Heading (deg.)	Log Speed (knot)	System Course (deg.)	System Speed (knot)	Current Direction (deg.)	Current Speed (knot)	Distance (mile)	Comment
100220	2201	+07:00	13 30.738S	091 09.729E	5049		80	3.5	93	4.2	152	0.3	2036	S/CO ON 079°
100220	2219	+07:00	13 30.556S	091 13.013E	5476		88	15.8	87	16.8	121	0.2	2039.1	R/UP ENG'S
100221	50	+07:00	13 24.671S	091 55.504E	5283		82	16.1	83	16.5	119	0.3	2081.2	A/CO TO 083°
100221	200	+07:00	13 22.131S	092 15.644E	5082		82	16.2	83	16.5	81	0.5	2100.9	S/B ENG'S
100221	207	+07:00	13 21.913S	092 17.018E	5120		18	3.8	11	3.4	152	0.6	2102.5	CHANGED ENG'S TO S/M
100221	211	+07:00	13 21.823S	092 17.022E	5120	St9	279	0.9	335	1.3			2102.6	IKMT NET STARTED
100221	230	+07:00	13 21.706S	092 16.508E	5122	St9	280	2.4	271	2.4	74	0.5	2103.1	IKMT NET DEEPEST
100221	340	+07:00	13 21.033S	092 14.555E	4836	St9	271	1.2	342	1.7			2105.6	IKMT NET FINISHED
100221	348	+07:00	13 20.883S	092 14.685E	4826		84	4.2	82	5	48	0.6	2106	CHANGED ENG'S TO T/M
100221	410	+07:00	13 20.130S	092 19.064E	4861		82	16.3	83	16.2	79	0.6	2110.3	R/UP ENG'S
100221	410	+07:00	13 20.128S	092 19.077E	4861		81	16.5	83	16.2	79	0.6	2110.3	S/CO ON 083°
100221	647	+07:00	13 16.485S	093 02.475E	5568		84	16.2	82	16.8	7	0.4	2152.9	SUNRISE & TURNED OFF REGULATION LIGHTS
100221	847	+07:00	13 12.681S	093 34.437E	5385		83	16.2	83	14.7	262	0.6	2184.4	ENTERED EEZ OF AUSTRALIA
100221	1903	+07:00	12 53.566S	096 14.415E	0		83	16.9	82	15.8	279	0.6	2341.8	SUNSET & PUT ON REGULATION LIGHTS
100222	623	+07:00	12 31.841S	099 17.414E	0		80	17.1	84	17	199	0.6	2521.9	SUNRISE & TURNED OFF REGULATION LIGHTS
100222	1010	+07:00	12 24.396S	100 19.679E	0		80	15.9	80	16.1	152	0.6	2583.3	CLEARED OUT EEZ OF AUSTRALIA
100222	1815	+07:00	12 08.569S	102 30.052E	4130		86	16.1	86	15.8	326	0.8	2712	S/B ENG'S
100222	1825	+07:00	12 08.449S	102 31.383E	3295		141	1	56	1.3			2713.3	STOPPED ENG'S
100222	1827	+07:00	12 08.431S	102 31.377E	3291		130	0.2	10	1			2713.4	CHANGED ENG'S TO E/M
100222	1831	+07:00	12 08.390S	102 31.370E	3287	St10	145	0.2	277	1.2			2713.5	CTD-CMS STARTED
100222	1836	+07:00	12 08.350S	102 31.366E	3284	St10	145	0.2	253	0.7			2713.5	SUNSET & PUT ON REGULATION LIGHTS
100222	1853	+07:00	12 08.264S	102 31.397E	3272	St10	144	0.6	87	0.6			2713.8	CTD-CMS DEEPEST
100222	1920	+07:00	12 08.155S	102 31.419E	3267	St10	135	0.1	238	0.4			2714.3	CTD-CMS FINISHED
100222	1927	+07:00	12 08.112S	102 31.409E	3270	St10	155	1.5	120	1.4			2714.4	IKMT NET STARTED
100222	1944	+07:00	12 08.619S	102 31.616E	3304	St10	154	2.5	122	2.5	142	0.5	2715.1	IKMT NET DEEPEST
100222	2100	+07:00	12 11.005S	102 32.179E	4524	St10	168	1.3	212	1.7			2717.8	IKMT NET FINISHED
100222	2111	+07:00	12 10.977S	102 32.611E	4681		79	2.6	47	3.2	333	0.5	2718.3	CHANGED ENG'S TO T/M
100222	2114	+07:00	12 10.905S	102 32.811E	4350		73	5.4	67	5.6	342	0.3	2718.6	S/CO ON 083°
100222	2133	+07:00	12 09.868S	102 36.284E	0		76	16.3	73	15.7	285	0.6	2722.2	ENTERED EEZ OF AUSTRALIA
100222	2134	+07:00	12 09.757S	102 36.676E	0		75	17.1	79	15.9	278	0.6	2722.4	R/UP ENG'S
100223	601	+07:00	11 51.671S	104 51.054E	0		82	16.3	84	15.7	254	0.7	2855.6	SUNRISE & TURNED OFF REGULATION LIGHTS
100223	1813	+07:00	11 28.205S	108 05.963E	0		84	16.5	81	15.6	309	0.6	3049.1	SUNSET & PUT ON REGULATION LIGHTS
100223	2100	+07:00	11 22.846S	108 50.593E	0		84	16.3	83	16	290	0.4	3093.2	PUT SHIPS CLOCKS AHEAD 1 HOUR
100223	2226	+08:00	11 21.972S	108 57.656E	0		85	16.3	86	15.5	328	0.8	3100.1	CLEARED OUT EEZ OF AUSTRALIA
100223	2300	+08:00	11 20.877S	109 06.696E	5257		83	16.8	82	16.4	309	1.1	3109	S/B ENG'S
100223	2314	+08:00	11 20.678S	109 08.174E	5182		120	0.5	350	1.1			3110.7	CHANGED ENG'S TO E/M
100223	2318	+08:00	11 20.621S	109 08.149E	5189	ST11	90	0.7	252	0.3			3110.8	CTD-CMS STARTED
100223	2336	+08:00	11 20.410S	109 08.016E	5192	ST11	110	0.4	355	2.2			3111.3	CTD-CMS DEEPEST
100224	2	+08:00	11 20.136S	109 07.896E	5199	ST11	116	0.6	309	1.4			3111.8	CTD-CMS FINISHED
100224	11	+08:00	11 20.045S	109 07.825E	5202	St11	161	1	238	0.9			3112	IKMT NET STARTED
100224	22	+08:00	11 20.327S	109 07.838E	5202	St11	160	2.7	143	1.7	192	2.5	3112.3	IKMT NET DEEPEST
100224	58	+08:00	11 21.270S	109 07.898E	5172	St11	161	2.1	137	1.5			3113.4	IKMT NET FINISHED
100224	102	+08:00	11 21.343S	109 07.897E	5163	St11	160	1.8	149	1.3			3113.5	IKMT NET STARTED
100224	114	+08:00	11 21.686S	109 07.937E	5161	St11	161	2.9	160	2	239	0.5	3114	IKMT NET DEEPEST
100224	232	+08:00	11 23.700S	109 08.509E	5066	St11	160	1.8	162	1.1			3116.3	IKMT NET FINISHED
100224	242	+08:00	11 24.193S	109 08.684E	5084		163	4.3	158	3.9	325	0.3	3116.9	CHANGED ENG'S TO T/M
100224	346	+08:00	11 37.691S	109 13.504E	4911		171	4.5	200	4.9	318	0.8	3131.2	CHANGED ENG'S TO S/M
100224	350	+08:00	11 37.820S	109 13.452E	4907	St12	200	2	219	2.3	246	1.3	3131.3	IKMT NET STARTED
100224	359	+08:00	11 38.079S	109 13.234E	4922	St12	200	2.5	205	2.4	296	0.8	3131.7	IKMT NET DEEPEST
100224	428	+08:00	11 38.884S	109 12.569E	4903	St12	201	1.6	256	2.9	233	7.7	3132.8	IKMT NET FINISHED
100224	433	+08:00	11 38.973S	109 12.467E	4903	St12	200	2.1	187	1.8	245	2.5	3132.9	IKMT NET STARTED
100224	445	+08:00	11 39.351S	109 12.137E	4895	St12	199	2.3	201	2.6	296	0.9	3133.5	IKMT NET DEEPEST
100224	521	+08:00	11 40.374S	109 11.089E	4902	St12	199	1.3	179	1.3			3135	IKMT NET FINISHED
100224	526	+08:00	11 40.472S	109 10.979E	4903	St12	198	1.9	222	2.9	239	2.3	3135.1	IKMT NET STARTED
100224	534	+08:00	11 40.753S	109 10.738E	4916	St12	202	2.3	212	2.8	284	0.9	3135.5	IKMT NET DEEPEST
100224	605	+08:00	11 41.602S	109 09.905E	4929	St12	202	1.4	237	2.2			3136.8	IKMT NET FINISHED
100224	613	+08:00	11 41.486S	109 10.117E	4933		57	6.2	52	6.2	295	1.2	3137.3	CHANGED ENG'S TO T/M
100224	616	+08:00	11 41.305S	109 10.340E	4927		59	8	49	7.5	306	1.1	3137.6	S/CO ON 068°
100224	645	+08:00	11 38.231S	109 15.891E	4853		64	16.5	63	15.7	307	0.7	3143.8	R/UP ENG'S
100224	645	+08:00	11 38.204S	109 15.942E	4854		65	16.5	62	16	296	0.7	3143.8	SUNRISE & TURNED OFF REGULATION LIGHTS
100224	850	+08:00	11 24.228S	109 45.579E	0		64	15.9	65	14.8	212	1.8	3176.2	ENTERED EEZ OF INDONESIA
100224	1856	+08:00	10 11.479S	112 06.498E	0		70	17.1	65	16.2	296	0.9	3332.5	SUNSET & PUT ON REGULATION LIGHTS
100225	624	+08:00	09 05.080S	114 52.789E	0		68	16.8	68	16.8	85	0.2	3509.7	SUNRISE & TURNED OFF REGULATION LIGHTS
100225	731	+08:00	08 58.012S	115 10.445E	0		57	16.5	59	17.6	96	0.4	3528.6	A/CO TO 042°
100225	811	+08:00	08 49.381S	115 16.761E	0		338	16.1	338	15.1	140	0.9	3539.7	S/B ENG'S
100225	820	+08:00	08 48.184S	115 16.296E	0		339	4.2	337	3.1	145	1	3541	CHANGED ENG'S TO S/M
100225	824	+08:00	08 48.063S	115 16.268E	0		334	3.1	348	2.5	130	0.4	3541.2	COM'CED TEST OF CRUSH ASTERN
100225	829	+08:00	08 47.683S	115 16.100E	0		337	6.3	334	5.7	167	0.4	3541.6	FINISHED TEST OF CRUSH ASTERN
100225	859	+08:00	08 45.429S	115 15.042E	0		315	4.2	320	3.6	86	0.5	3544	PILOT CAME ON BOARD