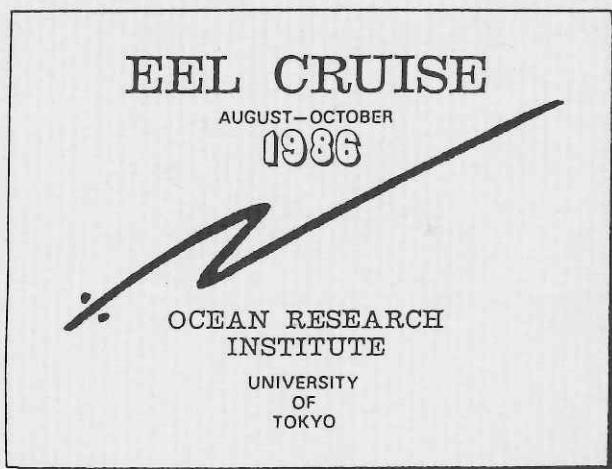


Preliminary Report
of
The Hakuhō Maru Cruise KH-86-4

August 26-October 2, 1986

Western Pacific Adjacent to Ryukyu,
Taiwan and Philippine Islands



Ocean Research Institute

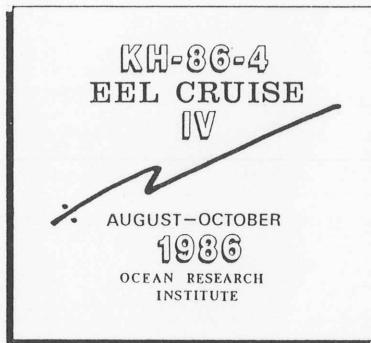
University of Tokyo

1988

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by
The Scientific Members of The Cruise
Edited by
Takeshi Kajihara
1988

CONTENTS

I.	PREFACE	1
II.	BACKGROUND AND OUTLINE OF THE CRUISE	2
III.	PRELIMINARY RESULTS	6
1.	Oceanographic characteristics of the study area H. Hasumoto, Y. Kawasaki and M. Kobayashi	
2.	Distribution of <u>Anguilla japonica</u> leptocephali T. Kajihara	
3.	Anguillid leptocephali O. Tabeta and N. Mochioka	
4.	Anguilliform and elopiform leptocephali O. Tabeta and N. Mochioka	
5.	Sampling leptocephali with reference to the diel vertical migration and the gears T. Kajihara, K. Tsukamoto, T. Otake, N. Mochioka, H. Hasumoto, M. Oya, and O. Tabeta	
6.	Ageing <u>Anguilla japonica</u> leptocephali with otolith K. Tsukamoto, A. Umezawa, O. Tabeta, N. Mochioka, and T. Kajihara	
7.	Otoliths of leptocephali K. Tsukamoto, A. Umezawa, N. Mochioka, O. Tabeta, and T. Kajihara	
8.	Otolith-tagging of leptocephali with fluorescent substance, alizarin complexon K. Tsukamoto and A. Umezawa	
9.	Fine structure of intestinal epithelium of the eel leptocephalus <u>Anguilla japonica</u> T. Otake and T. Kajihara	

10. Studies on the eyes and luminous organs in some deep-sea fishes H. Somiya
11. List of gonostomatid fish larvae T. Ozawa, S. Okamoto and A. B. Corpuz
12. Preliminary survey on the identification, systematics and spatial distribution of percoid larvae Y. Konishi
13. Studies on the distribution of eggs and larvae K. Matsushita
14. Palinurid and scyllarid phyllosoma larvae H. Sekiguchi
15. Studies on dispersion of tropical grass shrimps by the Kuroshio Current H. Mukai
16. Lucifer, epiplanktonic shrimps, collected during the KH-86-4 T. Kikuchi
17. Taxonomy and ecology of nano- and pico- phytoplankton N. Hosaka
18. Echo sounder measurement for small organisms and the echo in scattering layer T. Inagaki
19. Measurements of the current of the upper layer with drifter in the vicinity of spawning ground of Anguilla japonica M. Kobayashi and Y. Kawasaki

IV. DATA FROM CTD OBSERVATIONS 72

I. PREFACE

The KH-86-4 Cruise of the R.V. Hakuho Maru of Ocean Research Institute (ORI), the University of Tokyo, was conducted in the Western Pacific adjacent to Ryukyu, Taiwan and Philippine Islands during a period of 38 days from August 26 to October 2, 1986 with port call at Naha in Okinawa. ORI has carried out a series of expeditions on the breeding place and migration of the Japanese eel, Anguilla japonica. Present cruise was planned as the fourth one on the same objective.

This volume contains the oceanographic data obtained during the cruise. Brief summaries of the research carried out by the scientists aboard are also included.

International cooperation is indispensable for the study of animals showing wide-range migration such as the eel. In the present expedition, 5 foreign scientists from Philippine, Mexico, Taiwan, Korea and Thailand are planned to be aboard as the first step for the future international cooperative research on biology of the mysterious eel. Among them, the latter two were participants from the WESTPAC Program.

On behalf of all 32 scientists aboard, I wish to express our sincere thanks to the captain, the officers and the crew of the R.V. Hakuho Maru for their help during the cruise. Thanks are also due to the officers in the Intergovernmental Oceanographic Commission, UNESCO, the Japanese Ministry of Education, Science and Culture, the Ministry of Foreign Affairs and the Association of East Asian Relations for their diplomatic arrangement and for providing travel funds for WESTPAC members.

Takeshi Kajihara
Chief Scientist

II. BACKGROUND AND OUTLINE OF THE CRUISE

The spawning area of the Japanese eel, Anguilla japonica, has long been a mystery for biologists, while that of the American and the European eel were outlined in the early part of this century by Schmidt (1922) to be located in the southern Sargasso Sea in the North Atlantic Ocean. In 1973 and 1975, three Hakuho Maru cruises were carried out for the same purpose in the eastern waters of the Taiwan Island and a total of 54 leptocephali of the Japanese eel were collected in the area of 21-24° N, 125-130° E. All collected larvae, however, exceeded 45 mm in body length and no eggs and newly hatched larvae were obtained, yet. In consideration of geophysical data on the Kuroshio Current, the spawning area of the Japanese eel seems to be located in the more southern area than those investigated in the previous cruises. Thus, the oceanographic stations are expanded to 14° N in this expedition.

Under the overall objective of "Studies on the spawning area of the Japanese eel and the marine pelagic ecosystem surrounding it", the following research topics were investigated:

- (1) distribution and transportation of leptocephali of the Japanese eel and other Anguilliform fishes,
- (2) hydrographic observations in the study area,
- (3) taxonomy and assessment of abundance of ichthyoplankton, micronekton and fish eggs,
- (4) transportation and dispersion of lobsters and shrimps,
- (5) taxonomy and ecology of phyto- and zooplankton,
- (6) function and morphology of eyes and luminous organs in deep-sea fishes, and
- (7) characteristics of scientific echo-sounder.

The cruise consisted of two legs (Table 1). In the former leg of the cruise (Leg 1) from August 26 (Tokyo) till September 14 (Okinawa) 1986, spacial distribution of Anguillid leptocephali was mainly studied over a wide range. Based on the result of Leg 1, intensive sampling of A. japonica was conducted in the latter leg (Leg 2) from September 20 (Okinawa) till October 2 (Tokyo), 1986. The location of observation stations and the track chart are given in Fig. 1.

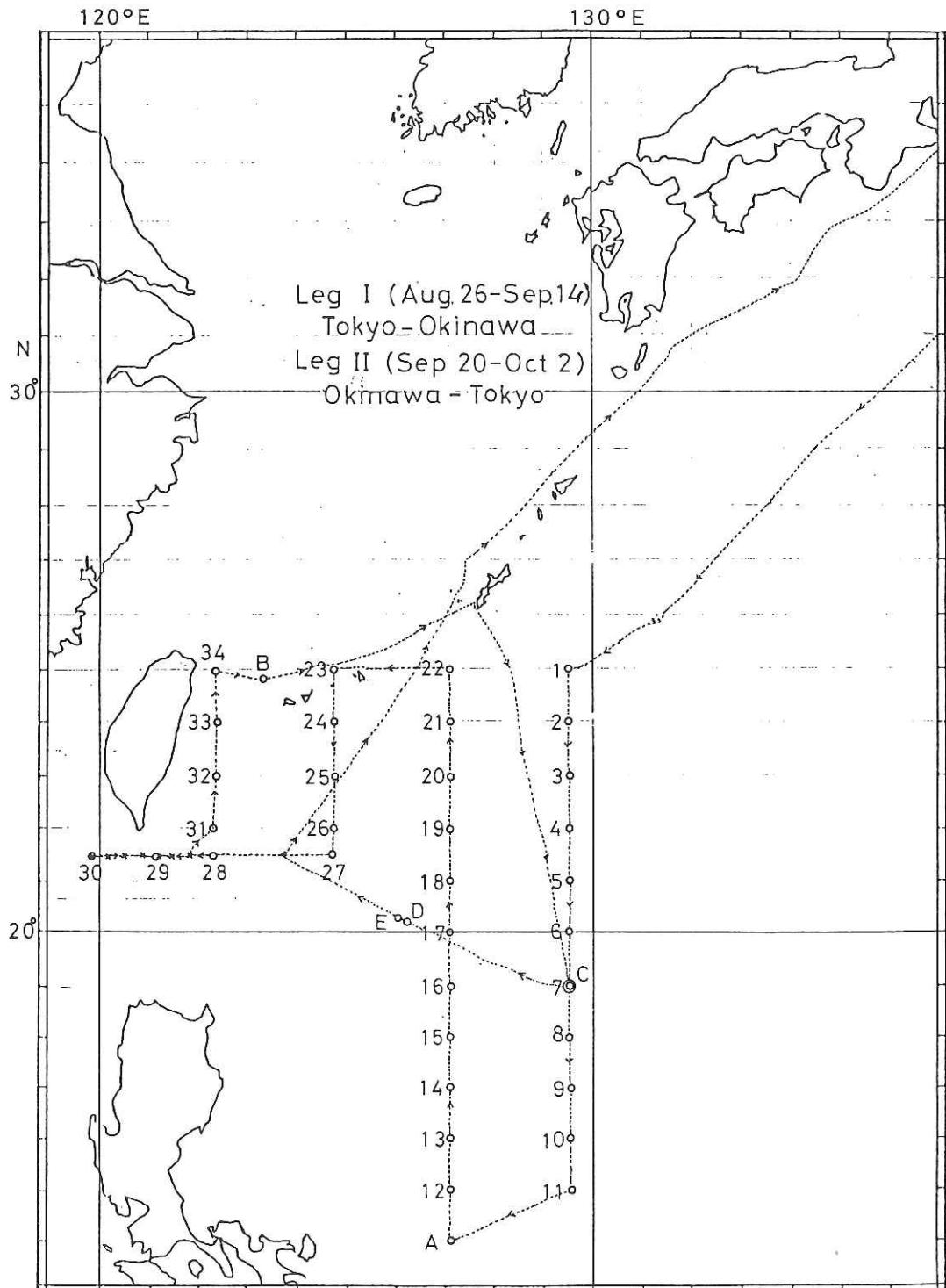


Fig. 1 Track chart and observation stations of the KH-86-4 cruise of the Hakuho Maru.

Table 1. Cruise itinerary

	Arrival	Departure
Tokyo	*****	August 26, 1986
Naha	September 14	September 20
Tokyo	October 2	*****

During Leg 1, a single plankton sample was collected at 35 stations (Sts. 1-34 and A, Fig. 1) by a standardized oblique tow using a 3 m Isaacs-Kidd Midwater Trawl (IKMT) fully lined 0.5 mm Nitrex netting and having a mouth area of 8.7 m². Standard tow consisted of two consecutive oblique tows with W-shaped vertical track. Its characteristics were: maximum depth = ca. 500 m; fishing time = 130 min; ship's speed = 2.5-3.5 kt during reeling out, 1.5-2.0 kt during reeling in; reeling speed = 0.8 m/s. In addition, horizontal tow at sea surface using ORI Net (0.66 mm mesh, 2.0 m² at mouth) was conducted twice at each station during Leg 1, each of which was operated for ca. 30 min at ship's speed of 1.5-2.0 kt. During Leg 2, 40 min horizontal tow with IKMT was mainly conducted at 7 discrete depth strata between 10 m and 400 m at Sts. C, D and E. In addition, 8 horizontal tows with ORI Net at 50-125 m depth strata for 20 min in each operation and 2 oblique tows with Hexagon Net (1-8 mm mesh, hexagon shape mouth of 10.4 m²) at 25-100 m deep for 60 min were carried out at St. C. Temperature, salinity and dissolved oxygen were measured with CTDO (Conductivity, Temperature, Depth and Oxygen) profiler (Neil Brown Mark III B) at every 1 m from the surface to 1000 m deep. Water current was calculated based on these physical data.

The names and specialities of the 32 scientists who participated in the cruise are listed in Table 2.

Table 2. Scientists aboard

Takeshi KAJIHARA*D	Ocean Res. Inst., Univ. of Tokyo	Marine ecology
Hiroshi MUKAI*L	Ocean Res. Inst., Univ. of Tokyo	Marine ecology
Katsumi TSUKAMOTO*E	Ocean Res. Inst., Univ. of Tokyo	Fish biology
Tsuguo OTAKE*E	Ocean Res. Inst., Univ. of Tokyo	Fish biology
Yasuhiro KAWASAKI	Ocean Res. Inst., Univ. of Tokyo	Fish.oceanography
Hiroshi HASUMOTO*E	Ocean Res. Inst., Univ. of Tokyo	Oceanography
Machiko OYA*E	Ocean Res. Inst., Univ. of Tokyo	Fish biology
Tadashi INAGAKI	Ocean Res. Inst., Univ. of Tokyo	Fish. ecology
Koichiro NAKAMURA	Ocean Res. Inst., Univ. of Tokyo	Marine ecology
Tomohiko KIKUCHI	Ocean Res. Inst., Univ. of Tokyo	Plankton
Kazuo UCHIDA	Ocean Res. Inst., Univ. of Tokyo	Fish biology
Nobuhito HOSAKA	Ocean Res. Inst., Univ. of Tokyo	Plankton
Toshiro SARUWATARI	Ocean Res. Inst., Univ. of Tokyo	Fish biology
Hiroshi SENOU	Ocean Res. Inst., Univ. of Tokyo	Fish biology
Amane HAYASHI	Ocean Res. Inst., Univ. of Tokyo	Fish. ecology
Tesu ICHIKAWA	Ocean Res. Inst., Univ. of Tokyo	Fish biology
Hiroya SUGISAKI	Ocean Res. Inst., Univ. of Tokyo	Plankton
Katsumi MATSUSHITA*L	Faculty of Agr., Univ. of Tokyo	Fish. science
Tsuneo KAJI	Faculty of Agr., Univ. of Tokyo	Fish. science
Oske S. NISHIZAKI	Faculty of Agr., Univ. of Tokyo	Fish. science
Akima UMEZAWA	Tokyo Univ. of Fisheries	Fish biology
Osame TABETA*V	Shimonoseki Univ. of Fisheries	Fish biology
Noritaka MOCHIOKA	Faculty of Agr., Kyushu Univ.	Fish biology
Takakazu OZAWA*L	Faculty of Fish., Kagoshima Univ.	Fish biology
Shohei OKAMOTO	Faculty of Fish., Kagoshima Univ.	Fish biology
Abellino CORPZ	Faculty of Fish., Kagoshima Univ.	Fish biology
Hideo SEKIGUCHI*L	Faculty of Fish., Mie Univ.	Marine biology
Hiroaki SOMIYA	Faculty of Vet. Med., Azabu Univ.	Fish physiology
Yoshinobu KONISHI*L	Nansei Regional Fish. Res. Lab.	Fish biology
Wann-Nian TZENG	Dept. Zool., National Taiwan Univ.	Fish biology
Tae-Won LEE*W	Dept. Oceanogr., Chungnam Univ.	Fish biology
Rangsan CHAYAKUL*W	Marine Fish. Div., Dept. Fish.	Fish biology

*D Chief scientist (Director of the cruise)

*V Vice director

*L Group leader

*E Member of executive committee

*W WESTPAC scientist

III. PRELIMINARY RESULTS

1. Oceanographic characteristics of the study area

Hiroshi Hasumoto, Yasuhiro Kawasaki,
and Masato Kobayashi

Information on water temperature, salinity and other oceanographic variables in the western subtropical North Pacific provides a basis for understanding the distribution and recruitment of larvae of the Japanese eel, Anguilla japonica. Cast of CTD (Neil Brown Mark III B) down to 1000 m depth were carried out at 34 stations (Fig. 1). Stations 1 to 11 were located along $129^{\circ} 35' E$ meridian between 15° and $25^{\circ} N$ (Section I). Station A and stations 12-27 were located along $127^{\circ} 10' E$ between 14° and $25^{\circ} N$ (Section II). Stations 23-27 were located along $124^{\circ} 45' E$ between $21^{\circ} 30' N$ and $25^{\circ} N$ (Section III), and station 28 and stations 31-34 were located along $122^{\circ} 20' E$ between $21^{\circ} 30' N$ and $25^{\circ} N$ (Section IV). Using the data sets of temperature and salinity, thermosteric anomaly (cl/t), geostrophic flow (cm/sec) and geopotential anomaly (dynamic meter) relative to 1000 db surface were calculated.

i) Distribution of temperature, salinity and thermosteric anomaly

Surface temperatures in the study area were commonly higher than $28^{\circ} C$ except stations 1 to 3, and 8 to 11 on Section I (Fig. 2). The seasonal thermoclines were shallowest near the northern end of each section, although vertical temperature gradient in the thermocline tended to increase toward east. A saline water exceeding 34.9 extended northward at ca. 100 m depth (Fig. 3). Since this high salinity water mass was confined between the isopycnal surface with thermosteric anomaly of 450 and 350 cl/t (Fig. 4), this water mass can be identified as the North Tropical Saline Water (Masuzawa, 1967). Below 500 m depth, the North Pacific Intermediate Water (Reid, 1965), of which core has salinity of less than 34.2 and thermosteric anomaly of 125 cl/t, was commonly found in the north of $20^{\circ} N$ (Figs. 3 and 4).

ii) Geostrophic flow

Figure 5 are illustrated east-west geostrophic velocities relative to 1000 db. A strong eastward current with a velocity of 25 cm/sec or higher was present between 22° and 23° N on Section I and between 23° and 24° N on Section II, III and IV. This can be identified as the Subtropical Countercurrent (Yoshida and Kidokoro, 1967 ; Uda and Hasunuma, 1969). On Section III, a strong westward current with a velocity of more than 50 cm/sec was found between $21^{\circ} 30'$ and 22° N. It is suggested that this current is a part of anticyclonic eddies. Such westean flow was not observed on Section IV because the Kuroshio flows north-eastward on eastan side of Taiwan.

iii) Geopotential topography

Figure 6 depicts geopotential topography relative to 1000 db in the study area. The geopotential anomaly of more than 2.5 dynamic meter was found east of Taiwan, indicating the presence of an anticyclonic eddy. On the north-east side of this anticyclonic eddy, a cyclonic eddy was observed. The geopotential anomaly in the center of this cyclonic eddy was less than 2.1 dynamic meter. Apparently, the surface water flows eastward along the contour of the geopotential anomaly of 2.3 dynamic meter between the anticyclonic and cyclonic eddies. The pattern of the surface water movement is consistent with that of the geostrophic current (Fig. 5), suggesting also the presence of the Subtropical Countercurrent. In the region south of 20° N (Fig. 5), the eastward and westward flows alternate with each other, reflecting the presence of many eddies. Figure 7 shows the zonal volume transport in the upper 1000 m depth in the study area. There are some reports about the volume transport of the Subtropical Countercurrent and the Kuroshio in the east of Taiwan (Nitani, 1972 ; Hasunuma, 1978). The estimated volume transport of these current are about $15 \times 10^6 \text{ m}^3$ and $30 \times 10^6 \text{ m}^3*$, respectively. We consider that these volume transport are the proper values.

iv) Distribution of leptocephali related to oceanographic conditions

On this cruise, leptocephali of the Japanese eel were caught at stations 7, 10, 31, C and E. In general, leptocephali are mainly collected during the night in the upper layer above than 100 m depth, where the temperature

ranged from 27 to 22° C and the salinity from 34.3 to 34.9.

The areas where leptocephali were collected were located between anticyclonic and cyclonic eddies. Since the numbers of collected leptocephali were very limited, however, it is premature to draw any conclusion as to how and from where leptocephali were transported.

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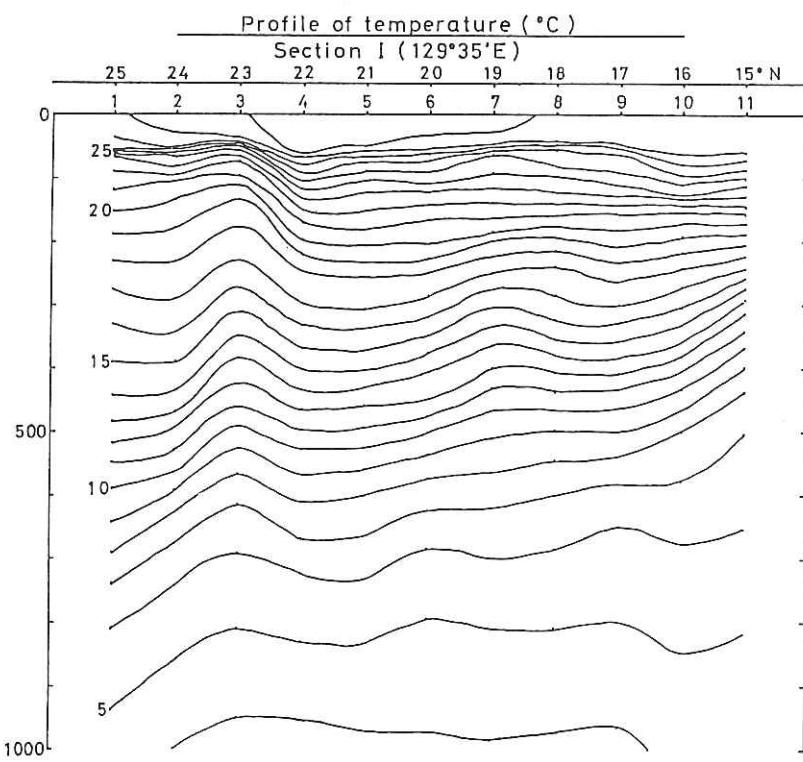


Fig. 2-1 Water temperature (°C) along Section I.

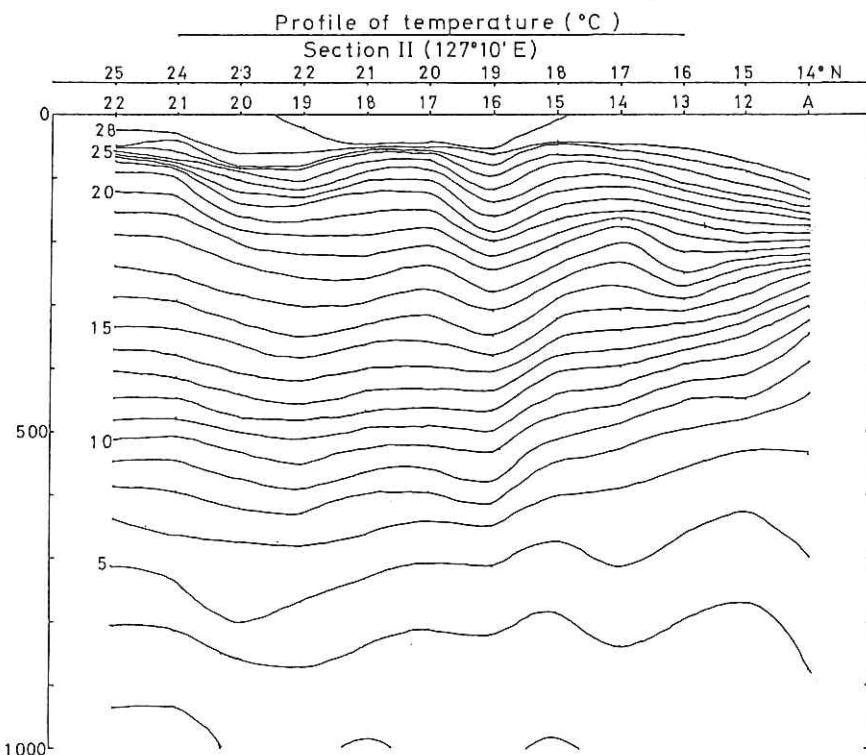


Fig. 2-2 Water temperature (°C) along Section II.

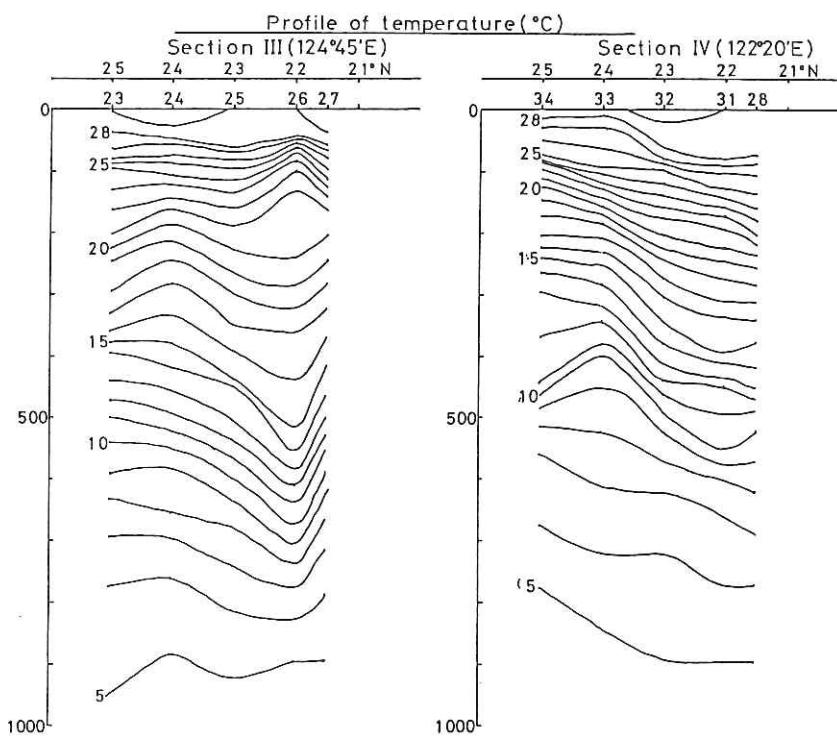


Fig. 2-3 Water temperature ($^{\circ}\text{C}$) along Section III and IV.

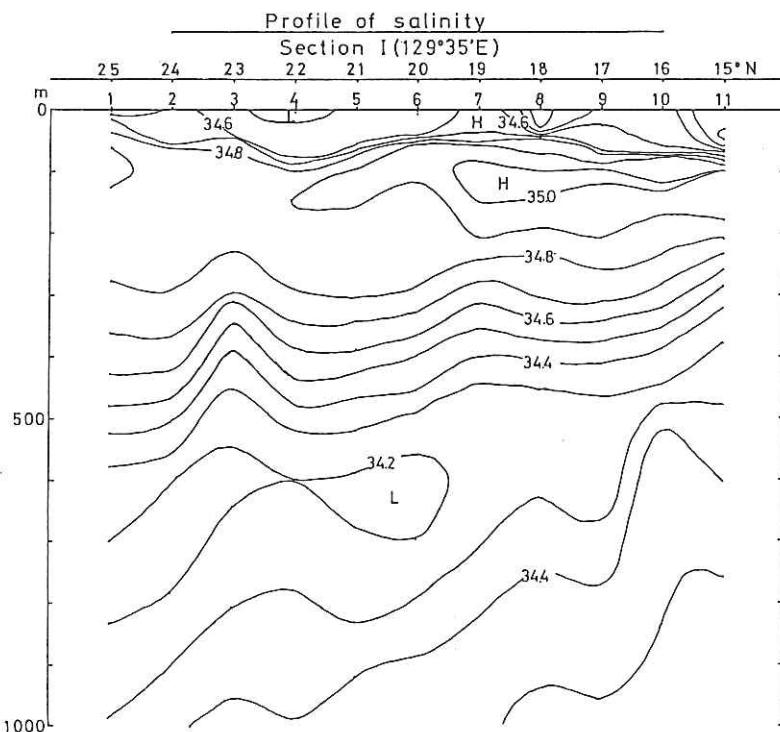


Fig. 3-1 Salinity ($^{\circ}/\infty$) along Section I.

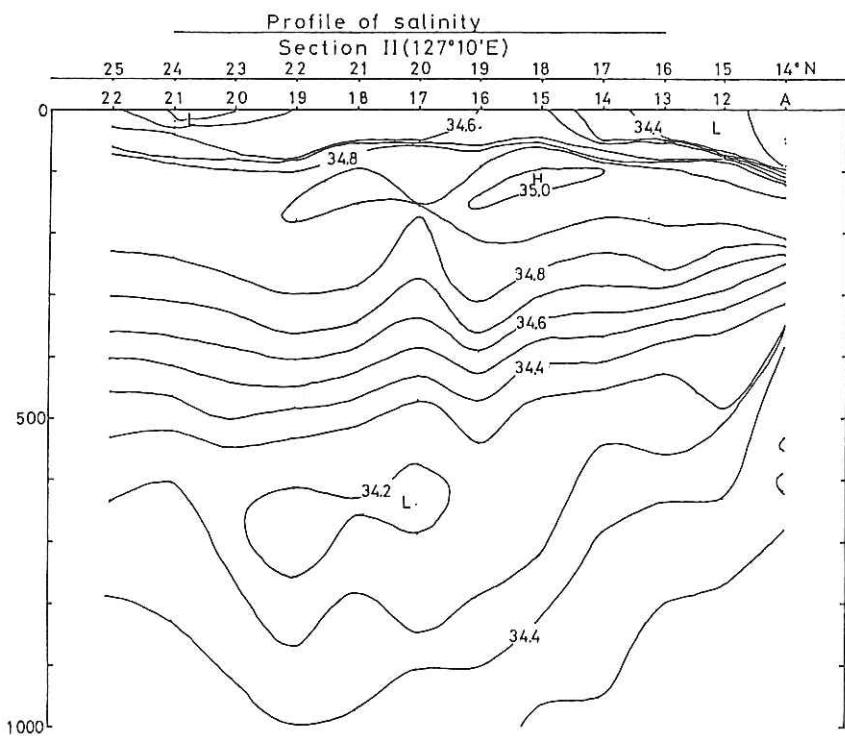


Fig. 3-2 Salinity (${}^{\circ}/_{\infty}$) along Section II.

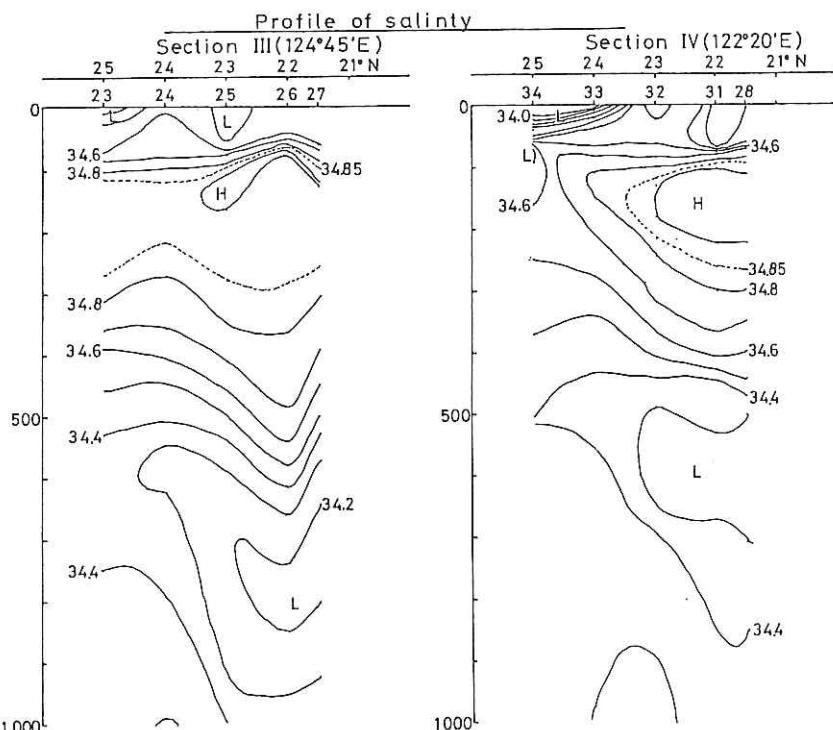


Fig. 3-3 Salinity (${}^{\circ}/_{\infty}$) along Section III and IV.

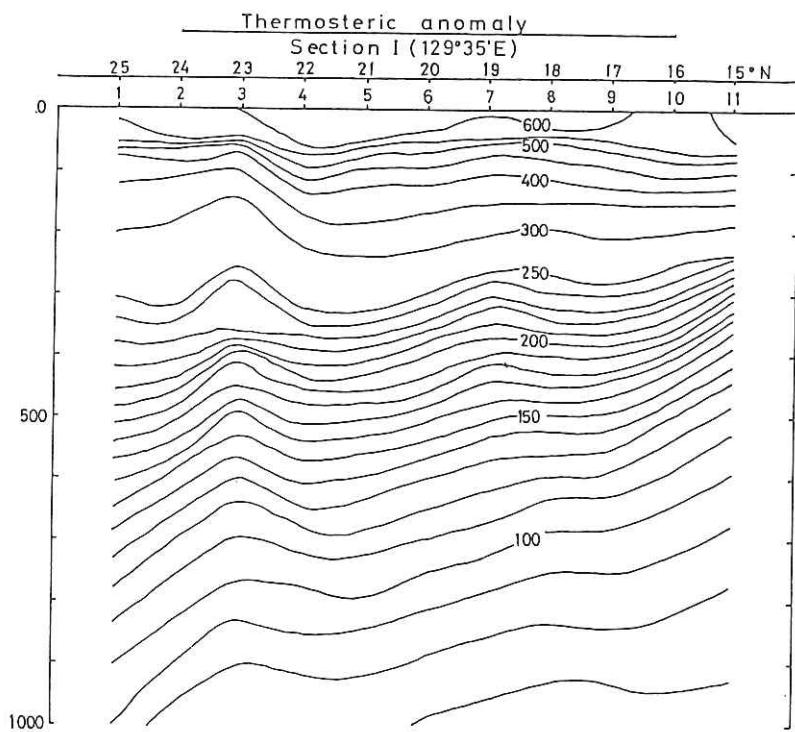


Fig. 4-1 Thermosteric anomaly (cl/t) along Section I.

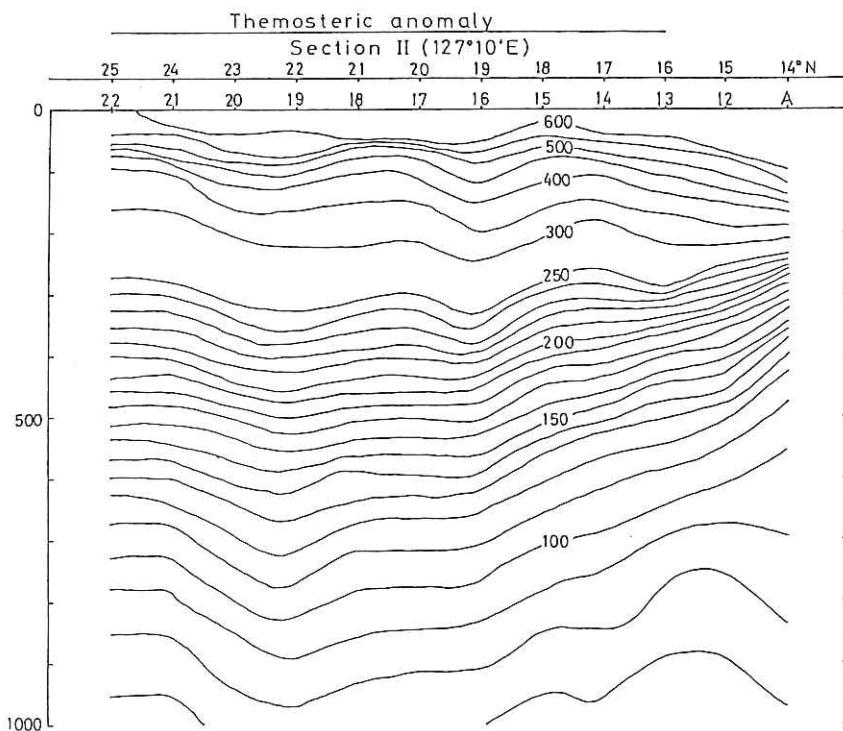


Fig. 4-2 Thermosteric anomaly (cl/t) along Section II.

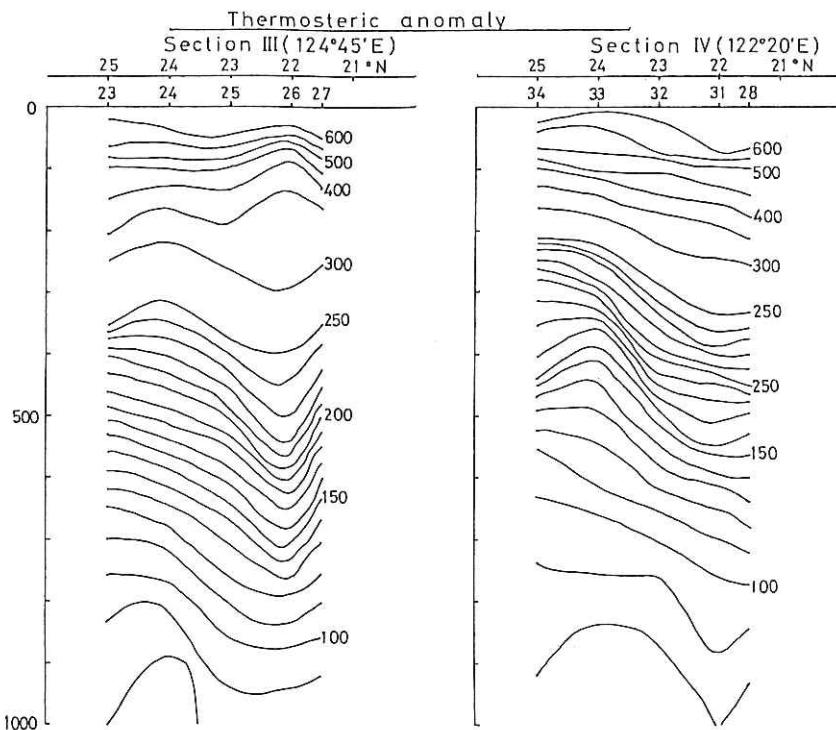


Fig. 4-3 Thermosteric anomaly (cl/t) along Section III and IV.

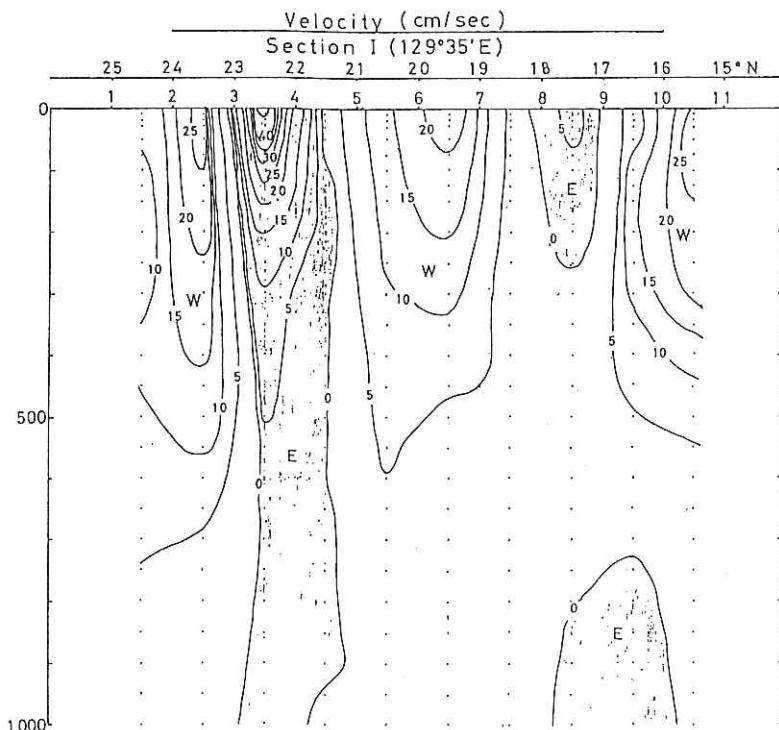


Fig. 5-1 Geostrophic flow along Section I.

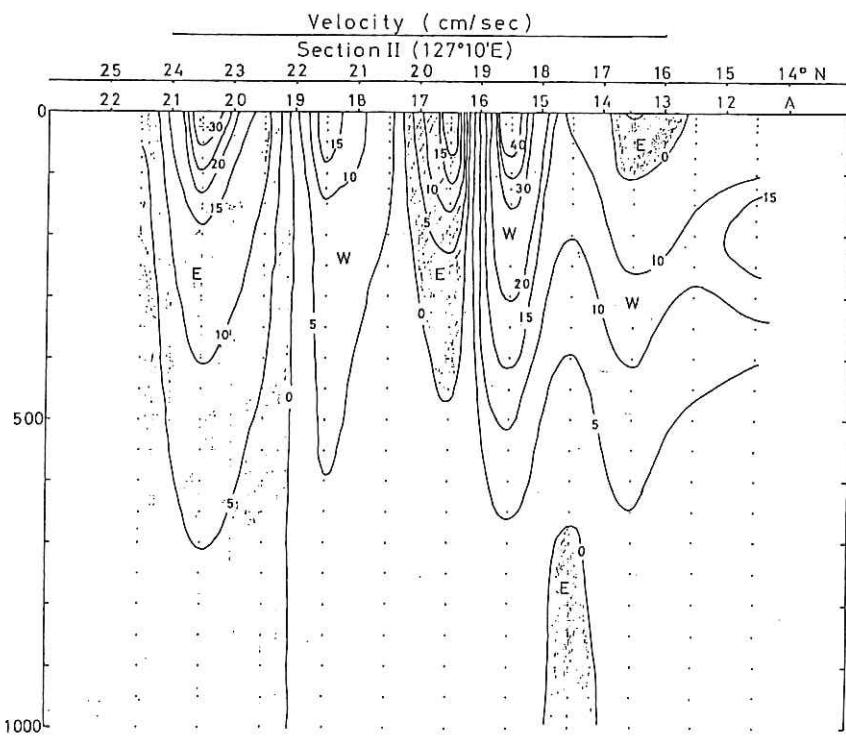


Fig. 5-2 Geostrophic flow along Section II.

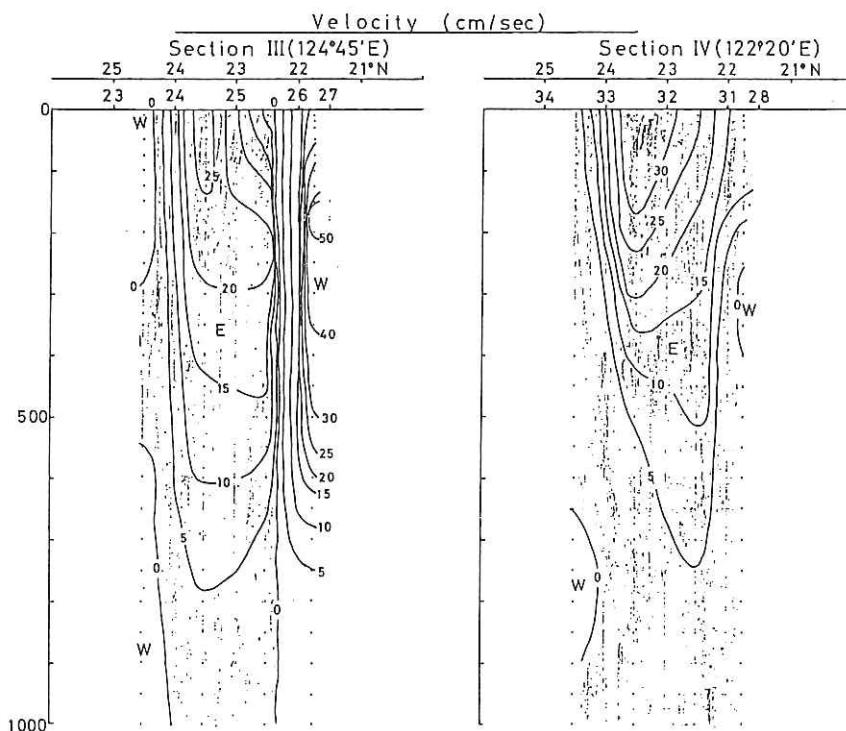
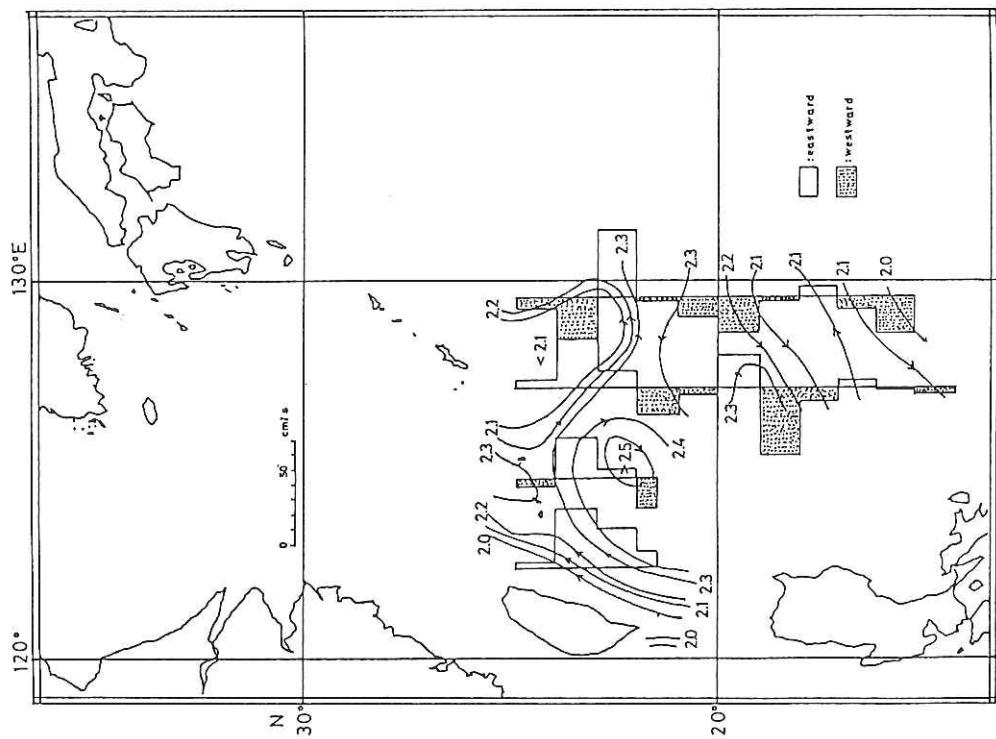
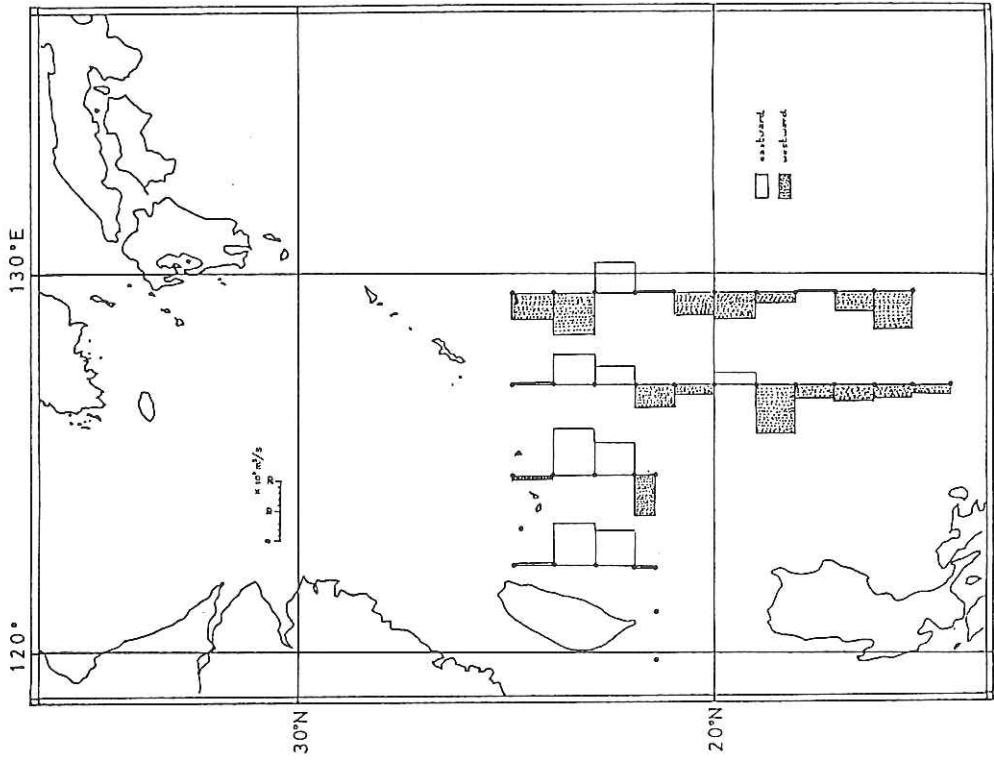


Fig. 5-3 Geostrophic flow along Section III and IV.



2. Distribution of Anguilla japonica leptocephali

Takeshi Kajihara

A survey cruise was conducted in the Western North Pacific between August 26 and October 2, 1986 to determine the horizontal distribution of Anguilla japonica leptocephali.

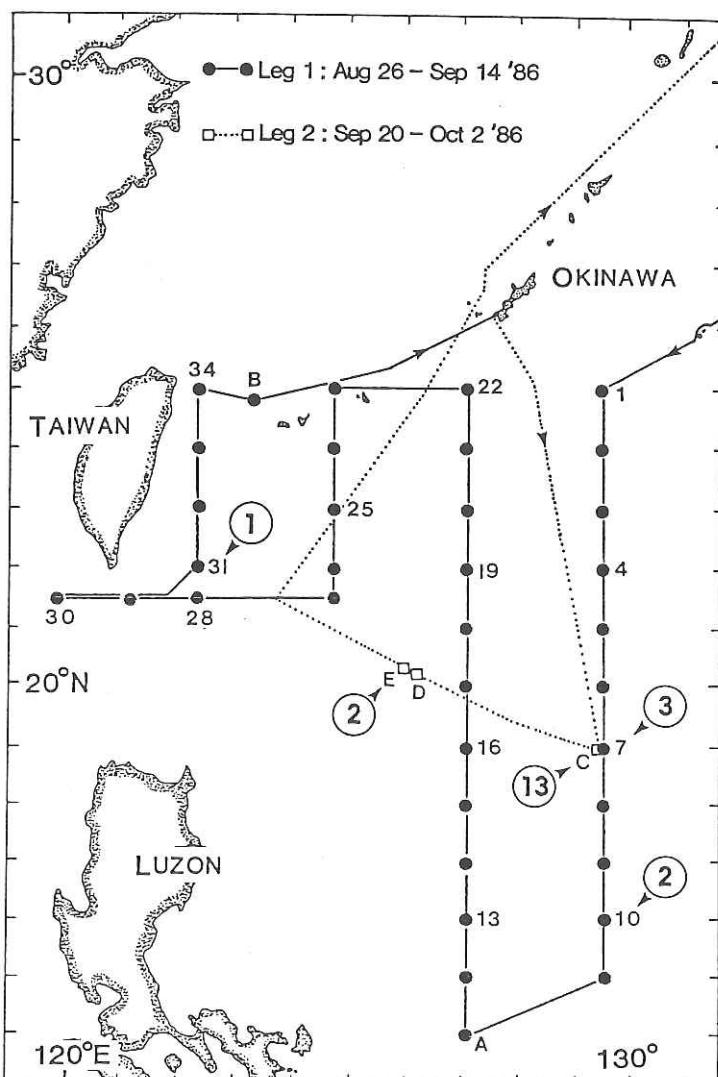


Fig. 8 Study area and observation stations, 1-34 and A-E. During Leg 1(solid line), sampling was made at 36 st. (1-34, A and B). C, D and E were surveyed during Leg 2 (dotted line). Numerals in circle are the number of A. japonica leptocephali collected.

A total of 21 *A. japonica* leptocephali were collected mainly by 3 m IKMT with 0.5 mm mesh at night. During grid survey in the former leg, standardized IKMT oblique tows (130 min towing from the surface to 500 m deep) showed that only 3 of the 35 stations were positive for *A. japonica* leptocephali (Fig. 8): 2 specimens at Station 7 (lat. $18^{\circ} 56'N$, long. $129^{\circ} 34'E$), 3 specimens at Station 10 (lat. $15^{\circ} 56'N$, long. $129^{\circ} 37'E$) and 1 specimen at Station 31 (lat. $22^{\circ} 02'N$, long. $122^{\circ} 25'E$). Most of leptocephali (18 specimens) occurred in the more southeastern area (lat. $15^{\circ} 56'-19^{\circ} 03'N$ and long. $129^{\circ} 11-37'E$) than those reported in the previous studies. The direction of water flow in this area was mainly southwest (see Fig. 6).

The size of specimens was roughly uniform and the mean (SD) was 43.1 mm (2.8), which was ca. 10 mm smaller than that of specimens ever collected (Fig. 9). The minimum record of this species (33.9 mm TL) occurred at Station 10 (Fig. 8).

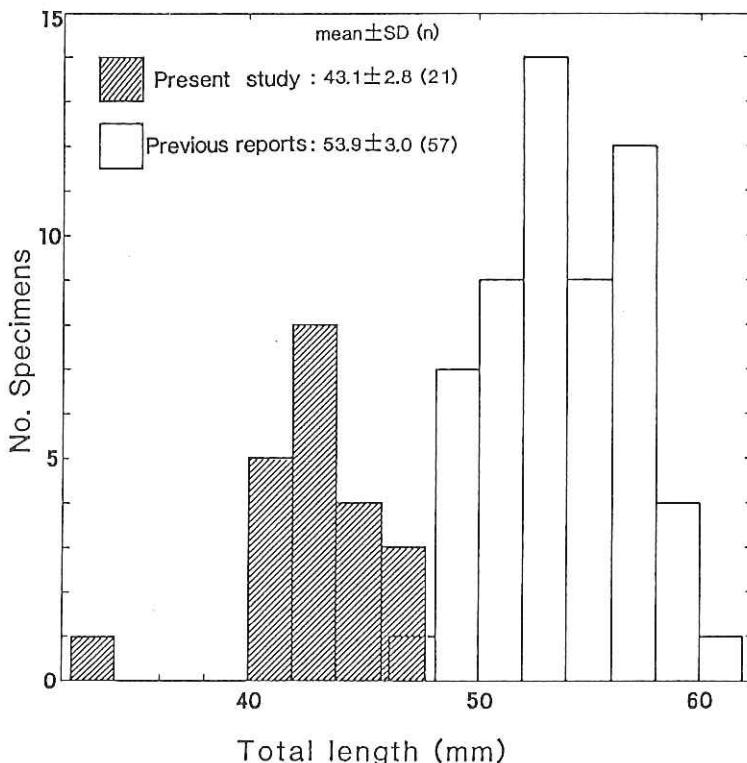


Fig. 9 Total length of *Anguilla japonica* leptocephali collected in this cruise in September 1986 (shaded). In comparison, size data of the specimens ever collected are also shown (open).

3. Anguillid leptocephali

Osame Tabeta and Noritaka Mochioka

A total of 27 specimens of the anguillid leptocephali were collected in the waters east of Luzon Island, the Philippines, and east of Taiwan during the cruise. Catalogue number, collection data, sectional lengths of body, number of myomeres, and number of teeth of the leptocephali are shown in Tables 3 and 4.

Twenty-one specimens shown in Table 3 were easily identified as A. japonica from the total number of myomeres (113-118). Total myomere of the six specimens shown in Table 4 (103-108) indicated that these leptocephali belong to the subtropical and tropical eels other than A. japonica. Tabeta et al. (1976), Tzeng (1982) and Tzeng and Tabeta(1983) recognized four species of eels in the Philippines and Taiwan : one short finned eel, A. bicolor pacifica, and three long finned eels, A. japonica, A. marmorata, and A. celebesensis. Fish No. 6 in Table 4 which has 4 ano-dorsal myomeres belongs to the short finned eel, while Fish No. 1-5 in Table 4 which have 8-14 ano-dorsal myomeres belong to the long finned eel. Therefore, the former was identified as A. bicolor pacifica, and the latter was identified as A. marmorata and/or A. celebesensis. The latter is described here as Anguilla spp. Fig. 10 indicates A. japonica, A. bicolor pacifica, and A. sp., from top to bottom. A key for the present anguillid leptocephali is given below :

- 1a Total myomeres 113-118 --- Anguilla japonica Temminck et Schlegel
1b Total myomeres 103-108 ----- 2
2a Ano-dorsal myomeres 4 ----- Anguilla bicolor pacifica Schmidt
2b Ano-dorsal myomeres 8-14 ----- Anguilla spp.

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Table 3. Catalogue number, collection data, sectional length of body, number of myomeres and teeth of Anguilla japonica larvae

Fish No.	Cat. No.	Date	Time	Sin. No.	Locality (Lat.)	Gear	Top*	TL (mm)	SL (mm)	PD (mm)	PA (mm)	A-D (mm)	IL (mm)	SN (mm)	ED (mm)	PW (mm)	PM (mm)	AM (mm)	VBY 1st	VBY 2nd	GM	Teeth last		
Cat. ORI KII-66-438*																								
1	No. 7-1	Sep. 1, 1986	0230-0446	7	18°55'5" N 129°34'.3" E	IKPT	W, 1500	44.3	43.5	30.5	33.0	2.5	3.5	1.0	7.5	11.6	71	78	8	18	42	47	27	
2	No. 7-2	Sep. 1, 1986	0230-0446	7	18°55'5" N 129°34'.3" E	IKPT	W, 1500	43.0	42.3	29.0	32.3	3.3	3.7	1.0	8.3	11.6	69	79	9	18	41	46	-	
3	No. 7-3	Sep. 1, 1986	0230-0446	7	18°55'5" N 129°34'.3" E	IKPT	W, 1500	46.2	45.6	30.3	34.3	4.0	3.8	1.1	7.3	11.6	69	78	10	19	41	46	27	
4	No. 10-1	Sep. 2, 1986	0220-0437	10	15°55'9" N 129°36'.9" E	IKPT	W, 1500	41.4	40.7	27.7	-	3.6	1.1	0	-	11.3	68	-	18	40	45	-		
5	No. 10-2	Sep. 2, 1986	0220-0437	10	15°55'9" N 129°36'.9" E	IKPT	W, 1500	33.9	33.3	23.0	25.8	2.2	3.5	1.0	6.5	11.6	68	78	8	18	40	47	28	
6	No. 31	Sep. 11, 1986	0512-0723	31	22°02'3" N 122°24.9" E	IKPT	W, 1500	40.5	40.0	27.0	-	3.5	1.0	0.9	-	11.6	66	77	10	15	-	45	-	
7	No. C-67	Sep. 23, 1986	0130-0158	C-67	19°02'8" N 129°25.5" E	ORI	U, 100	43.1	42.3	29.8	32.7	2.9	3.8	1.1	6.8	11.7	70	78	8	17	40	45	29	
8	No. C-13	Sep. 23, 1986	2156-2239	C-13	18°58'7" N 129°12.3" E	IKPT	U, 50*	43.0	42.3	29.7	32.3	2.6	3.7	1.0	9.0	7.0	11.6	70	78	7	18	39	46	28
9	No. C-14-1	Sep. 23, 1986	2249-2334	C-14	18°59'1" N 129°13.5" E	IKPT	U, 75	42.7	42.3	29.5	32.5	3.0	4.0	1.2	1.0	7.5	11.5	70	78	8	18	38	46	26
10	No. C-14-2	Sep. 23, 1986	2249-2334	C-14	18°59'1" N 129°13.5" E	IKPT	U, 75	41.0	40.0	27.7	30.1	2.4	4.0	1.2	1.0	6.3	11.6	68	76	6	18	39	46	27
11	No. C-15-1	Sep. 23-4, 86	2341-0031	C-15	18°58'5" N 129°15.2" E	IKPT	U, 150	43.4	42.7	29.0	36.4	-	4.0	1.2	1.0	-	11.3	65	76	-	15	39	45	-
12	No. C-15-2	Sep. 23-4, 86	2341-0031	C-15	18°58'5" N 129°15.2" E	IKPT	U, 150	42.8	42.0	28.8	32.5	3.7	3.8	1.0	1.0	7.2	11.6	68	78	9	18	40	46	-
13	No. C-15-3	Sep. 23-4, 86	2341-0031	C-15	18°58'5" N 129°15.2" E	IKPT	U, 150	41.8	40.8	29.0	31.5	2.5	4.0	1.3	1.0	7.1	11.6	71	79	7	18	40	46	29
14	No. C-15-4	Sep. 23-4, 86	2341-0031	C-15	18°58'5" N 129°15.2" E	IKPT	U, 150	43.4	42.5	29.0	32.6	3.6	3.8	1.1	1.1	7.5	11.4	69	78	7	18	39	45	28
15	No. C-15-5	Sep. 23-4, 86	2341-0031	C-15	18°58'5" N 129°15.2" E	IKPT	U, 150	44.0	43.3	29.3	33.3	4.0	4.0	1.2	1.0	7.4	11.7	69	81	10	15	39	43	27
16	No. C-15-6	Sep. 23-4, 86	2341-0031	C-15	18°58'5" N 129°15.2" E	IKPT	U, 150	45.4	44.8	30.7	34.2	3.5	3.9	1.0	1.0	7.3	11.5	69	77	7	17	38	45	26
17	No. C-15-7	Sep. 23-4, 86	2341-0031	C-15	18°58'5" N 129°15.2" E	IKPT	U, 150	45.9	45.2	31.7	35.4	3.7	4.1	1.2	1.1	7.5	11.5	69	80	8	15	37	44	27
18	No. C-19-1	Sep. 24, 1986	0429-0553	C-19	18°57'7" N 129°10.5" E	IKPT	U, 300	40.5	40.0	26.9	31.2	3.3	3.7	1.0	1.0	7.2	11.6	69	78	11	17	39	46	28
19	No. C-19-2	Sep. 24, 1986	0429-0553	C-19	18°55'7" N 129°10.5" E	IKPT	U, 300	47.0	46.0	32.4	35.7	3.3	4.1	1.1	1.1	8.1	11.7	71	80	8	19	41	48	27
20	No. E-1	Sep. 24-5, 86	2322-0014	E-1	20°17.9" N 126°00.5" E	IKPT	U, 150	46.5	45.6	32.0	35.0	3.0	4.0	1.1	1.1	7.2	11.4	68	77	7	17	38	46	28
21	No. E-2	Sep. 25, 1986	0028-0121	E-2	20°18.5" N 125°58.1" E	IKPT	U, 150	44.8	44.0	30.5	34.0	3.5	4.0	1.0	1.0	6.5	11.6	69	79	9	18	39	44	27

TL, total length; SL, standard length; PD, predorsal length; PA, preanal length; A-D, anal-dorsal myomeres; PM, preanal myomeres; A-DN, ano-dorsal myomeres; TM, total myomeres; PW, vertical blood vessels at myomere level; ED, snout length; ED, eye diameter; BD, body depth; IRPT, Isaacs Kidd plankton trawl; OOI, Ocean Research Institute net; Ilex, 4 m hexagon type net.

* Torn track (W, two repeated oblique tows) and wire out in waters.

** The Hakuto Maru, Ocean Research Institute, University of Tokyo.

*** with two buoys at the both sides of the bar.

Table 4. Catalogue number, collection data, sectional length of body, number of myomeres and teeth of the other *Anguilla* larvae

Fish No.	Cat. No.	Date	Time	Stn. No.	Locality (Lat.)	Gear	Tows*	TL (mm)	SL (mm)	PD (mm)	PA (mm)	A-D (mm)	IL (mm)	SN (mm)	ED (mm)	PW (mm)	PAN-A-DW (mm)	VIV 1st 2nd last	GM	Teeth					
Cat. ORI K1-86-488																									
1	No. 9	Sep. 1, 1986	1826-2034	9	16° 55'.2"N 129° 37.8"E	IRPT	W, 1500	32.5	31.9	20.8	24.6	3.8	3.3	0.8	7.5	106	70	14	37	43	22	1+1+5+ 8/1+3+4			
2	No. A-1	Sep. 3, 1986	0311-0530	A	14° 04'.2"N 127° 13.4"E	IRPT	W, 1500	47.3	46.1	30.1	35.2	5.1	4.0	1.1	1.0	9.2	104	57	68	10	16	39	42	24	0+1+5+ 9/1+2+6
3	No. A-2	Sep. 3, 1986	0311-0530	A	14° 04'.2"N 127° 13.4"E	IRPT	W, 1500	39.0	38.2	25.5	28.7	3.2	3.2	1.0	0.9	8.5	103	58	68	8	17	39	43	25	1+1+5+1/0/1+1+7
4	No. 12	Sep. 3, 1986	1232-1451	12	15° 05'.0"N 127° 12.8"E	IRPT	W, 1500	34.3	33.5	—	—	3.6	—	—	—	7.8	105	61	73	11	18	38	45	—	—
5	No. 33	Sep. 11-2, 86	2218-0020	33	24° 06'.8"N 122° 25.6"E	IRPT	W, 1500	41.3	40.3	27.1	31.1	4.0	3.5	1.0	0.9	9.3	104	59	70	10	15	38	42	25	1+1+6+ 9/1+6+7
6	No. 11	Sep. 2, 1986	1031-1239	11	14° 57.8"N 129° 33.9"E	IRPT	W, 1500	47.8	46.8	33.5	35.3	1.8	4.0	1.0	1.0	8.2	108	71	75	4	17	41	46	23	0+1+6+12/1+3+9

TL, total length; SL, standard length; PD, predorsal length; PA, preanal length; A-D, ano-dorsal length; IL, head length; ED, eye diameter; BD, body depth; TM, total myomeres; PDM, predorsal myomeres; PAN, preanal myomeres; A-DN, ano-dorsal myomeres; VIV, vertical blood vessels at myomere level; GM, pre-gill-bladder myomeres; IRPT, Isaacs Kidd plankton trawl.

* Towing track W, two repeated oblique tows; U, horizontal tow for 40 minutes) and wire out in meters.

** The Ijukubo Maru, Ocean Research Institute, University of Tokyo.

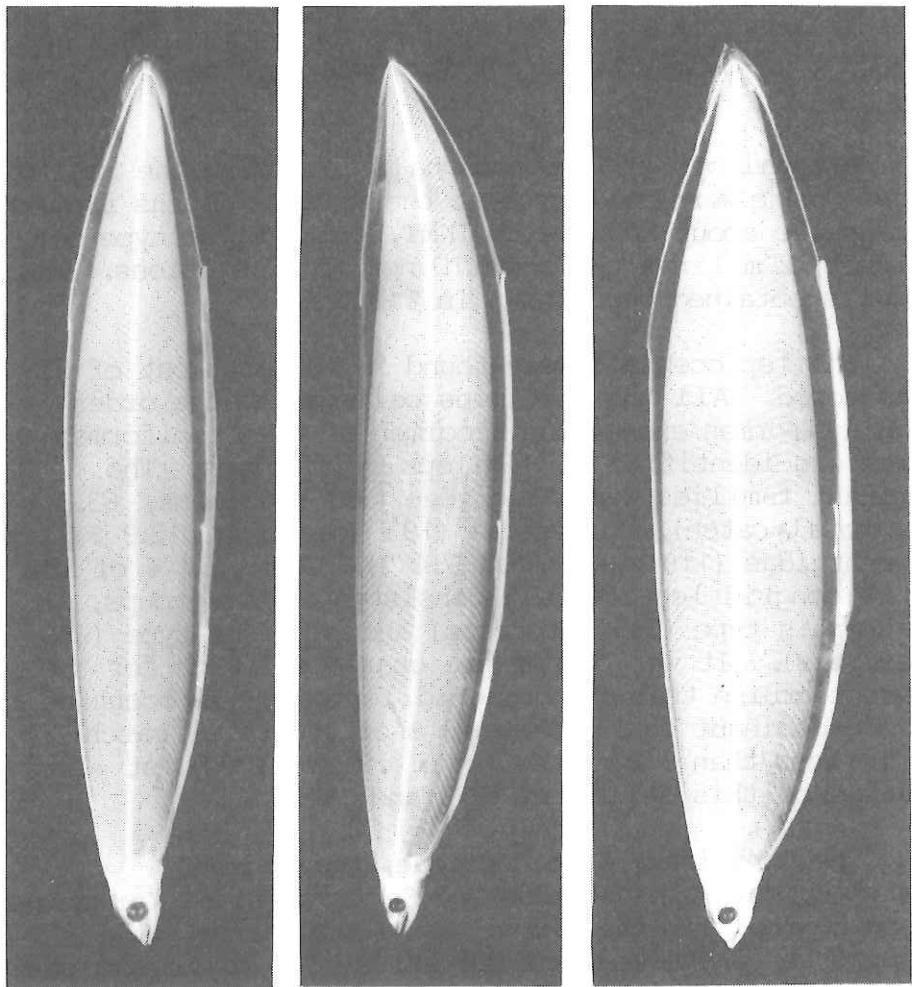


Fig. 10

Top: Anguilla japonica
Cat. ORI KH-86-4 No. C-14-1
42.3 mm SL

Middle: Anguilla bicolor
pacifica
Cat. ORI KH-86-4 No.11
46.8 mm SL

Bottom: Anguilla sp.
Cat. ORI KH-86-4 No. 33
40.3 mm SL

4. Anguilliform and elopiform leptocephali

Osame Tabeto and Noritaka Mochioka

A total of 1,497 leptocephali including the family Anguillidae were collected at the various depths from the surface to about 500 m with IKMT, 4 m Hexagon type net, ORI net, 2 m larva net and MTD net at 45 stations. The results obtained were shown in Table 5.

The leptocephali were found in 103 nets out of 229 nets towed. All the specimens belonged to the order Anguilliformes except one specimen of the Elopiformes which was identified as Megalops cyprinoides. The dominant families were Congridae (957 specimens, 63.3 % of the total catch), Muraenidae (193 specimens, 12.9 %), and Ophichthidae (110 specimens, 7.4 %). About 87 % of the total congrid leptocephali consisted of two groups, Gnathophis-type (543 specimens) and Ariosoma-type (289 specimens). It was one of the characteristics for the present cruise that the muraenid leptocephali occupied the second dominant family (ca. 13 % of the total catch), while less than 3 % of the total catch in the 1st - 3rd cruises of this series in 1973 and 1975.

The Congridae, Xenocongridae, Muraenidae, Nemichthyidae, Ophichthidae and Serrivomeridae larvae were found commonly in the almost whole study area, while occurrence of the Moringuidae larvae (11 specimens) was limited to the waters northeast of Taiwan. Family diversity showed a high value at the southern stations of the surveyed waters, and at the stations east of Taiwan and northwest of Yaeyama Islands. More than six families were recognized in these stations.

Table 5. Leptocephali collected in each station. Negative nets are omitted.

St. No.	Gear	Anguilliformes							Elopi forms			Total						
		<u>Anguilla japonica</u>	Other <u>Anguilla</u> spp.	Congridae	Muraenidae	Ophichthidae	Xenocongridae	Nemichthyidae	Serrivomeridae	Nettastomatidae	Moringuidae	Dysommatidae	Synaphobranchidae	Cymatidae	Derichthyidae	Muraenesocidae	Elopidae	Unidentified
1	IKPT	1																1
2	HEXAGON				2													3
2	IKPT		1															1
3	IKPT		2		2	1												5
4	IKPT		6					2										8
5	IKPT				4	1												6
6	IKPT		7									1						8
6	ORI-1		3															3
7	IKPT	3	3															6
9	IKPT	1	19															20
10	IKPT	2	35															37
10	ORI-1		4															4
10	ORI-2			1														1
11	IKPT	1						1										2
A	IKPT	2	11		1	1		6									1	22
A-K2	2m							1										1
12	IKPT	1	3	2				1										10
12-G2	ORI			1														1
13-G1	ORI	6						1										7
13-G2	ORI	4																4
13	IKPT	31	3		1			4										39
13	ORI-1	1																1
13	ORI-2	4			1			1										6
14	IKPT	5	1															7
15	IKPT		1									1						2
16-K2	2m	1																1
16	IKPT	4	1					1	1									7
16	ORI-1	1																1
16	ORI-2	7																7
17	IKPT			1			1											2
18	IKPT		2			1												3
19-G1	ORI							1										1
19-G2	ORI	3						1										4
19	IKPT	5	4			1												10
19	ORI-1	1						2										3
20	IKPT	4	6		3							1						14
21	IKPT		1	1														2
22-K1	2m	1																1
22	IKPT	2					1						1					4
22	ORI-2	1																1
23	IKPT		3									1						4
24	IKPT	23	1	3	1	1			1									30
24	ORI-2	1																1
25	IKPT	18	5									1						24
26	IKPT		1															1
27	IKPT	2	2			1	1											6
27	ORI-2	2							1									3
M-1	MTD(50m)							1										1
M-4	MTD(30m)	1						1										2
M-4	MTD(100m)	1																1
M-5	MTD(50m)	1																1
M-6	MTD(10m)	1																1
M-6	MTD(30m)		1															1
30	IKPT	5	1	1					2									9
30	ORI-X	1			1													2
30	ORI-1	1																1
30	ORI-2	4																4

Table 5. Continued.

St. No.	Gear	Anguilliformes												Elopi forms				Total
		<u>Anguilla japonica</u>	<u>Other Anguilla spp.</u>	Congridae	Muraenidae	Ophichthidae	Xen cong ridge	Nemichthysidae	Serrivomeridae	Netta stomatidae	Moringuidae	Dysommatidae	Synaphobranchidae	Cymatidae	Derichthyidae	Muraenesocidae	Elpidiae	Unidentified
M-8	MTD(100m)			1	1													2
M-9	MTD(150m)			1	1													1
M-10	MTD(75m)				1													1
29	IKPT		1	2	1									1				5
M-12	MTD(10m)						1											1
M-12	MTD(50m)		1															1
M-12	MTD(150m)		1															1
31	IKPT	1	2					2										5
32	IKPT		4						1			2	1					8
33	IKPT	1	47	2	7			2			2						3	65
33	ORI-X		1															1
34	IKPT		25	2	2												1	30
34	ORI-X														1			1
34	ORI-1			1														1
B-1	IKPT	8	7	1	3													19
B-2	HEXAGON	5	3	1	2													11
B-3	HEXAGON	6	7	1	2	3												20
B-4	IKPT	25	12	7	4				2	3	1							54
B-G1	ORI	1	1		1													3
B-G2	ORI		4															7
B-G3	ORI	32	11	12	9			2			1							70
B-G4	ORI	9	1		1													11
B-5	IKPT	78	8	17	2			2			1							108
B-6	HEXAGON	88	9	11	6			2			2							120
B-7	HEXAGON	102	16	6	9			6	1	1	4							145
B-8	IKPT	64	9	6	2			3							1			83
B-9	IKPT	49	8	7	6			3			1							74
B-10	HEXAGON	76	9	6	5			3	1							1		101
C-2	IKPT	2	3	1														6
C-3	IKPT	2	4	1				1										8
C-G2	ORI							1										1
C-G6	ORI		5	1														6
C-G7	ORI	1																1
C-4	IKPT	15	2	1	1	1				1								21
C-5	IKPT					1												1
C-9	IKPT	3	13	1														17
C-10	IKPT										1							1
C-11	IKPT	3			2	1			1									4
C-12	IKPT								2									5
C-13	IKPT	1		2		1			2									6
C-14	IKPT	2			4													6
C-15	IKPT	7		12	4													23
C-16	IKPT	10			4			2										16
C-17	IKPT	3						1										4
C-18	HEXAGON	5	1					1			1							8
C-19	HEXAGON	2	3	2				1		2								10
D	IKPT		2	1				2										5
E-1	IKPT	1		5				1	5									12
E-2	IKPT	1		5	1	1		1	1									10
E-3	IKPT		10	3	2	1		3										19
Total		21	6	957	193	110	68	63	27	13	11	10	4	2	2	1	1	1497

Number of nets towed and of the leptocephali collected with ORI net at the surface and with IKMT at layers from the surface to about 500 m depth during day and night (St. 1-34) were shown in Table 6. This table indicates that the leptocephali were mainly collected with the IKMT at the layers from the surface to about 500 m depth during night.

Table 6. Number of nets towed and leptocephali collected at the surface and 0 - ca. 500m layer in day and night during the general survey (Stns. 1 - 34)

Towing layer	Day		Night	
	Surface * ¹	0 - ca. 500m * ²	Surface * ¹	0 - ca. 500m * ²
Number of nets towed	35	14	47	21
Number of positive nets	1	12	16	21
Number of leptocephali collected	1	58	40	345
Range* ³	1	1-14	1-7	1-65
Mean* ⁴	1	4.8	2.5	16.4

*1. Surface tows by ORI net.

*2. Two repeated oblique tows by IKPT.

*3. Range of number of leptocephali collected in a positive net.

*4. Mean value of number of leptocephali collected in a positive net.

5. Sampling leptocephali with reference to the diel vertical migration and the gears

Takeshi Kajihara, Katsumi Tsukamoto,
Tsuguo Otake, Noritaka Mochioka,
Hiroshi Hasumoto, Machiko Oya,
and Osame Tabeta

In order to determine the most efficient sampling method of Anquilla japonica leptocephali, the diel change of vertical distribution of leptocephali and sampling efficiency of gears were examined.

Forty-min horizontal tow at 2.0 kt ship speed by 3 m Isaacs-Kidd Midwater Trawl (IKMT) with 0.5 mm mesh was conducted by night and day at each 7 discrete depth layers, 10, 20, 50, 80, 130, 200 and 400 m deep, at Station C, lat. $18^{\circ} 56' - 19^{\circ} 04'$ N and Long. $129^{\circ} 10' - 35'E$, September 22-24, 1986 (Fig. 8). A total of 13 experimental tows were carried out except a tow at 200 m deep by night. In order to filter the same water mass at each tow, a drifting rador buoy with drag was used to mark water mass and the experimental tows were made around the buoy. The details of rador tracked drifter used in the study and the trajectory of the drifter and net towing stations would be illustrated below (Figs. 25 and 26, respectively).

Number of leptocephali taken by night (60 fish) was 2.6 times larger than those sampled during daytime (23 fish)(Fig. 11). Most of leptocephali (85 %) of night sample were taken at shallow layers, 10, 20, 50 and 80 m deep, while no leptocephali occurred at layers shallower than 80 m by day. All of 10 leptocephali of A. japonica were also taken at shallow layers between 10 and 50 m deep by night. Upper limit of daytime sample and the layers of maximum catch by night roughly coincided with a sharp thermocline observed at 70-80 m deep (Fig. 12). A. japonica leptocephali seem to be obtained most efficiently by a horizontal night tow at layer just up to a thermocline.

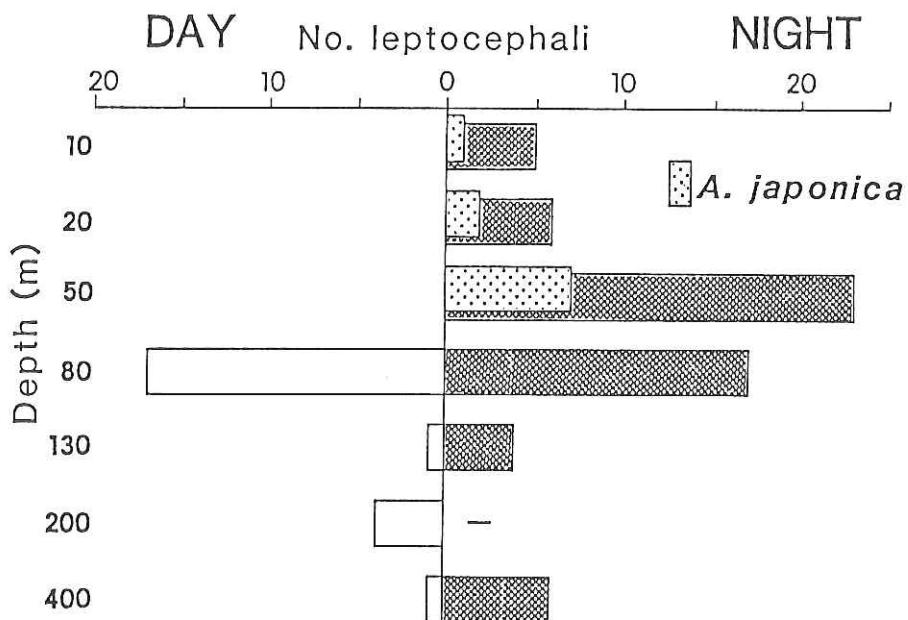


Fig. 11 Vertical distribution of leptocephali collected by IKMT by night and day at Station C, September 22-24, 1986.

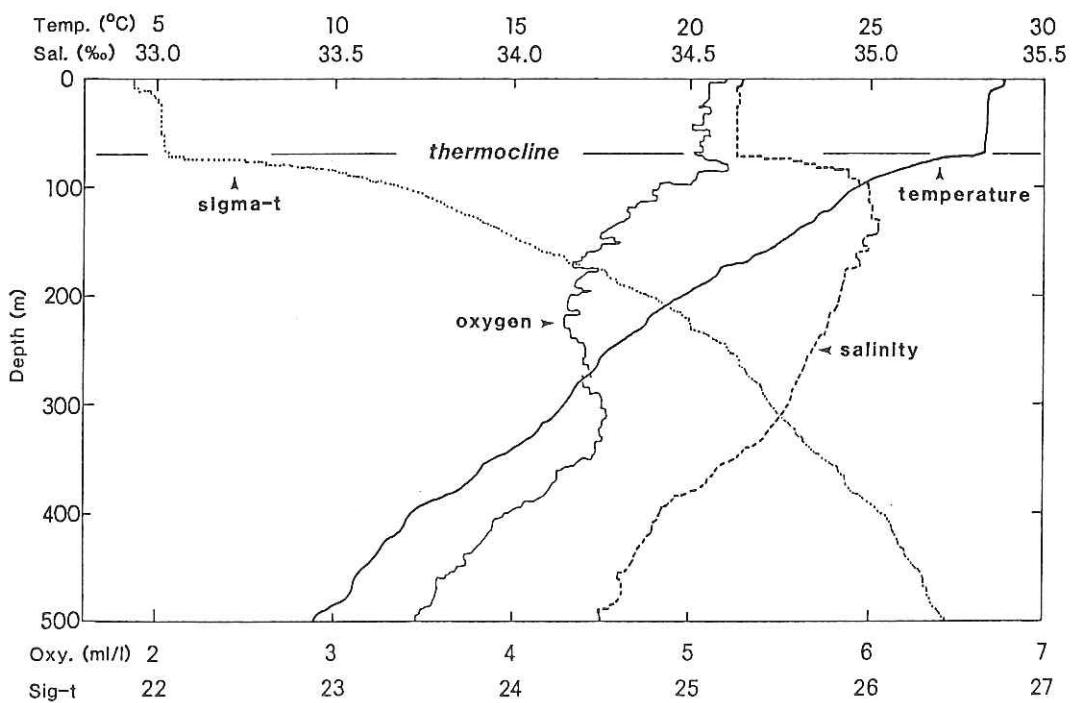


Fig. 12 Vertical profile of temperature, salinity, dissolved oxygen and density(sigma-t) between the sea surface and 500 m deep at St. C3, September 22-24, 1986.

Two types of nets were compared: (1) 3 m IKMT fully lined 0.5 mm Nitrex netting with an irregular pentagonal mouth of 8.7 m², and (2) Hexagon Net with gradually changing mesh from 8 mm at the mouth to 1 mm at the tail and having hexagon-shaped mouth opening of 10.4 m². No special opening-close apparatus was attached to the both nets. In order to compare the efficiency and property of these two types of nets, a pair of tows by IKMT and Hexagon Net were made twice by day and three times by night at Station B (Fig. 8), lat. 24° 45'-49'N and long. 123° 11'-19'E, September 12-13, 1986. Each tow was consisted of two consecutive oblique tows with W-shaped vertical track and its characteristics were: maximum depth = 100-150 m; sampling duration = ca. 50 min; ship's speed = 3.0 kt during reeling out and 1.5 kt during reeling in; reeling speed = 0.5-0.8 m/s. Similar to Depth Distribution Analysis described above, sampling was made in a fixed water mass marked by a drifting radar buoy with drag.

A total of 397 leptocephali were collected by Hexagon Net during 5 experimental tows, whereas IKMT collected 338 leptocephali (Fig 14). Although the number of leptocephali caught per unit haul was a little larger (1.17 times) in Hexagon Net than in IKMT, the sampling efficiency corrected by the water volume filtered (40.8 and 75.7 X 1000 m³ for IKMT and Hexagon Net, respectively) was higher in IKMT (8.3 specimens/1000 m³) than in Hexagon Net (5.2 specimens/1000 m³), mostly because mesh size of Hexagon Net (1-8 mm) was too large for leptocephali smaller than ca. 25 mm TL. Number of families of leptocephali collected was equal between IKMT and Hexagon Net (9 families). Number of leptocephali per haul collected by night was 2.4 and 7.9 times larger than those collected by day for IKMT and Hexagon Net, respectively.

The mean TL for both night and day samples by IKMT (34.6 mm) was smaller than that by Hexagon Net (51.3 mm). The minimum sizes of leptocephali taken by IKMT and Hexagon Net were 8.8 and 10.0 mm TL and the maximums were 207.0 and 246.5 mm TL, respectively. Hexagon Net caused a bias in sampling leptocephali smaller than 25 mm TL while IKMT could collect fewer leptocephali exceeding 40 mm TL than Hexagon Net.

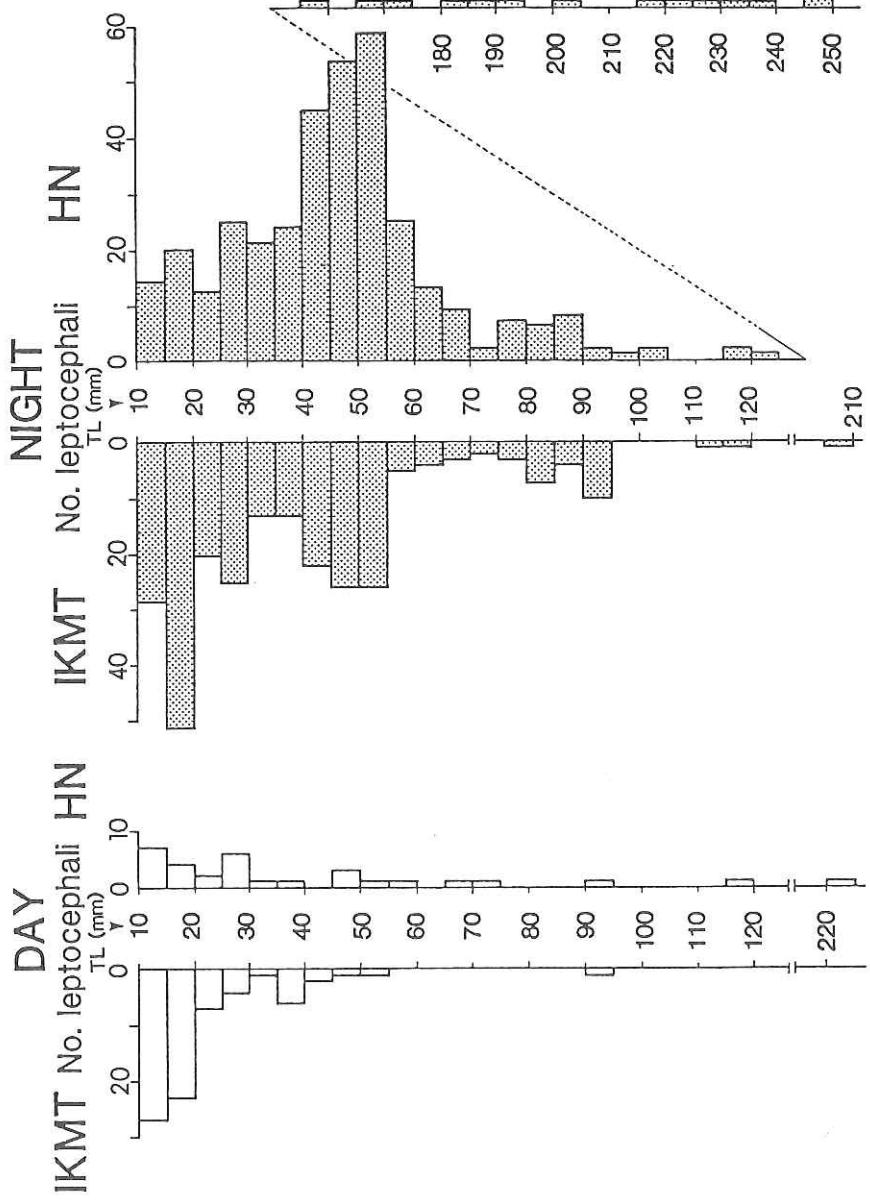


Fig. 13 Comparison of size frequency distribution of leptocephali between IKMT and Hexagon Net samples collected at St. B, September 12-13, 1986.

6. Ageing *Anguilla japonica* leptocephali with otolith

Katsumi Tsukamoto, Akima Umezawa, Osame Tabeta,
Noritaka Mochioka, and Takeshi Kajihara

In order to determine the spawning season of the Japanese eel *Anguilla japonica*, age and birth date of the leptocephali were estimated with the daily growth increment in otoliths of 14 specimens collected during the cruise.

The sagitta of the leptocephalus (40.5-47.0 mm in TL) was a translucent, laterally compressed oval structure of about 155 μm diameter with a dark opaque core (6 μm in long axis) in the center (Fig. 14). Distinct concentric growth increments (ring) were observed around the core. About 80 % specimens examined had a distinct dark ring (heavy discontinuous zone) with about 11 μm diameter near the core, which may be a "hatch check" formed at hatching.

The age of leptocephali was roughly uniform, 71.9 + 3.4 days (mean + SD)(Fig. 15, Table 7). Their birth date ranged from June 28 to July 18, 1986 and the mean was July 12, suggesting that this species spawned in summer. This result roughly coincided with the estimated spawning season of the elver migrating to the Japanese coast, whose mean + SD was July 22 + 41.8 days ranging from April to November (Tsukamoto, unpublished) .

Table 7. Age and birth dates of *Anguilla japonica* leptocephali estimated with otolith growth increments.

Fish No.*	TL (mm)	Otolith size (μm) Diameter	Age Radius (day)	Birth Date	Sampling Stn. Date	Locality Lat.(N)	Long.(E)
6	40.5	154.0	84.9	75 Jul. 28	31 Sep. 11	22° 02.3'	122° 24.9'
7	43.1	148.2	84.1	74 Jul. 11	C-G7 Sep. 23	19° 02.8'	129° 25.5'
8	43.0	152.3	81.3	67 Jul. 18	C-13 Sep. 23	18° 58.7'	129° 12.3'
9	42.7	160.0	88.7	78 Jul. 07	C-14 Sep. 23	18° 59.1'	129° 13.5'
11	43.4	154.0	85.3	70 Jul. 15	C-15 Sep. 23	18° 58.5'	129° 15.2'
12	42.8	154.2	85.2	70 Jul. 15	C-15 Sep. 23	18° 58.5'	129° 15.2'
13	41.8	151.9	82.2	74 Jul. 11	C-15 Sep. 23	18° 58.5'	129° 15.2'
14	43.4	161.2	87.8	70 Jul. 15	C-15 Sep. 23	18° 58.5'	129° 15.2'
15	44.0	152.2	78.8	70 Jul. 15	C-15 Sep. 23	18° 58.5'	129° 15.2'
16	45.4	149.2	82.1	70 Jul. 15	C-15 Sep. 23	18° 58.5'	129° 15.2'
17	45.9	165.5	87.9	78 Jul. 07	C-15 Sep. 23	18° 58.5'	129° 15.2'
18	40.5	147.9	85.7	72 Jul. 14	C-19 Sep. 24	18° 55.7'	129° 10.5'
19	47.0	162.6	87.3	69 Jul. 17	C-19 Sep. 24	18° 55.7'	129° 10.5'
21	44.8	151.9	81.7	69 Jul. 18	E-2 Sep. 25	20° 18.5'	125° 58.1'
mean	43.5	154.7	84.5	71.9 Jul. 12			
SD	1.88	5.53	2.94	3.42 5.5			
max	47.0	165.5	88.7	78 Jul. 18			
min	40.5	147.9	78.8	67 Jun. 28			

*:corresponding to Fish No. in Table 3.

Fig. 14 Otolith of Anquilla japonica leptocephalus.
A: Sagitta of the leptocephalus
Fish No. 17, TL: 45.9 mm

B: High magnification of central part of sagitta in Fish No. 19, TL: 47.0 mm
Arrow with "h" indicates "hatch check", a heavy discontinuous zone formed at hatching and arrow with "c", the core of otolith.

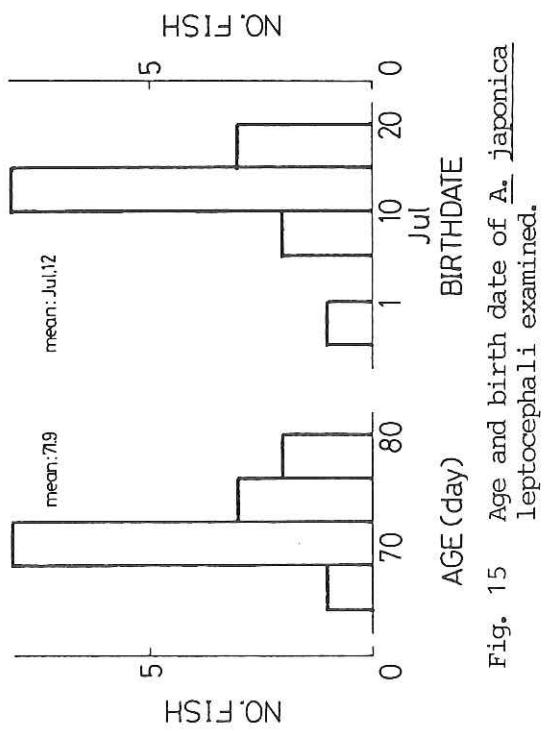
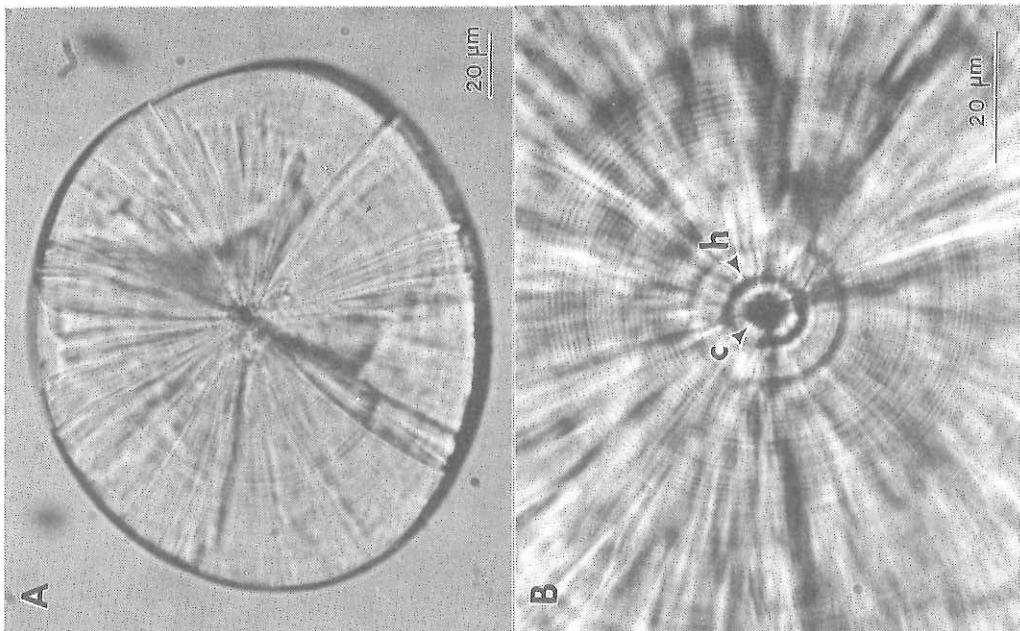


Fig. 15 Age and birth date of A. japonica leptocephali examined.

7. Otoliths of leptocephali

Katsumi Tsukamoto, Akima Umezawa,
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and Takeshi Kajihara

Biological informations of leptocephali are not so many, and especially, few study has been done on the otoliths of leptocephali. The aim of the present report is to accumulate fundamental knowledge on their otoliths and to examine the possibility of age determination with the otolith microstructure in daily precision. The further objective is to apply these knowledge to the identification of leptocephali.

After identifying leptocephali by N. M. and O. T., a sagitta or both lapillus and sagitta of right side were removed under a desecting microscope by K. T. and A. U. from a freshly caught specimen before preservation. *Asteriscus* was not examined here, though it could be extracted from some specimens. Otoliths were mounted in Euparal (Chroma-Gesellshaft) on a glass microscope slide. The core and edge of sagitta were traced through a light microscope (Nikon Optiphot) with a camera lucida. The longest part was measured as a radius, and a diameter of otolith was defined as a extention of the radius to the opposite edge. A bipartite structure of a narrow opaque band (discontinuous zone) and adjacent wider translucent band (incremental zone) was regarded as one growth increment (ring). Increments were also traced and counted along the radius through a light microscope with a camera lucida at 1600x magnification. Total length of leptocephali of anguillidae and nettastomatidae was measured after preservation in 10 % (v/v) formalin buffered with sodium tetraborate, and others were measured before that.

Leptocephali of a total of 57 individuals of 20 different species were examined. Their size, sampling location, otolith radius and number of increments etc were listed in Table 8. Their photographs were shown in Fig. 16, and the summeries of their morphology, as follows:

Anguilliformes

Anguillidae

Anguilla japonica (TL: 40.5-47.0 mm)

Sagitta (Fig. 16-1a,b): transparent, oval, flat disk; a nucleus in the center of otolith; diameter ranging 147.9-165.5 μm ; clear distinct increments; the number of increments counted in an otolith ranging 67-78.

Lapillus (Fig. 16-2a,b): transparent, circular, flat disk; an almost central nucleus; diameter ranging 83.0-109.6 μm ; growth increments, visible.

Anguilla marmorata/celebesensis (TL: 41.3 mm)

Sagitta (Fig. 16-3a,b): transparent, oval, flat disk; a nucleus in the center of otolith; diameter, 134.6 μm ; clear distinct increments; the number of increments 79.

Congridae

Gnathophis nystromi nystromi (TL: 25.5-96.8 mm)

Sagitta (Fig. 16-4a,b): transparent, circular, flat disk; an eccentric nucleus; diameter, 49.0-172.8 μm ; clear distinct increments with some checks (heavy distinct dark ring); the number of increments, 30-95.

Gnathophis nystromi ginanago (TL: 86.1 mm)

Sagitta (Fig. 16-5a,b): transparent, circular, flat disk; nucleus, eccentric; diameter, 149.8 μm ; clear distinct increments with some checks; the number of increments, 97.

Gnathophis ? xenica (TL: 40.0-57.8 mm)

Sagitta (Fig. 16-6a,b): transparent, circular, flat disk; nucleus, eccentric; diameter, 67.9-106.2 μm ; clear distinct increments with some checks; the number of increments, 31-70.

Gnathophis sp. (TL: 13.4-46.4 mm)

Sagitta (Fig. 16-7a,b): transparent, circular, flat disk; nucleus, eccentric; diameter, 34.3-92.0 μm ; clear distinct increments with some checks; the number of increments, 16-53.

Ariosoma type I (TL: 85.8, 150.0 mm)

Sagitta (Fig. 16-8a,b): transparent, circular, flat disk; a nucleus in the center; diameter, 58.4, 85.8 μm ; unclear, faint increments.

Ariosoma type III (TL: 194.0-307.2 mm)

Sagitta (Fig. 16-9a,b): transparent, circular, flat disk with several additional, fan-shaped bosses around the edge; a nucleus in the center; diameter, 101.5-430.0 μm ; clear concentric increments, but uncountable because of additional bosses.

Ariosoma type C2 (TL: 126.6 mm)

Sagitta (Fig. 16-10a,b): transparent, circular, flat disk; a nucleus in the center; diameter, 95.4 μm ; unclear concentric increments.

Congridae sp. (TL: 63.3 mm)

Sagitta (Fig. 16-11a,b): transparent, circular, flat disk; a nucleus, eccentric; diameter, 124.2 μm ; clear increments of 57.

Muraenidae

Uropterygius sp. (TL: 46.1, 48.0 mm)

Sagitta (Fig. 16-12a,b): transparent, roughly circular, flat disk; a nucleus, eccentric; diameter, 154.9, 258.6 μm ; clear concentric increments with some checks; the number of increments, 69, 111.

Muraenidae sp. (TL: 62.0, 95.0 mm)

Sagitta (Fig. 16-13a,b): transparent, roughly circular, flat disk; a nucleus, eccentric; diameter, 93.7, 186.2 μm ; clear concentric increments of 39 and 101.

Ophichthidae

Ophichthidae sp. (TL: 46.0-196.4 mm)

Sagitta (Fig. 16-14a,b): transparent, circular, flat disk; a nucleus, eccentric; diameter, 48.9-223.0 μm ; clear concentric increments of 39-133.

Xenocongridae

Xenocongridae sp. (TL: 48.8 mm)

Sagitta (Fig. 16-15a,b): transparent, oval, flat disk; a nucleus, eccentric; diameter, 137.2 μm ; unclear increments of 81.

Nemichthyidae

Nemichthys scolopaceus (TL: 206.7 mm)

Sagitta (Fig. 16-16a,b): transparent, circular, flat disk; a nucleus, eccentric; diameter, 82.0 μm ; clear increments of 62.

Nettastomatidae

Nettastomatidae sp. (TL: 123.2 mm)

Sagitta (Fig. 16-17a,b): transparent, dewdrop-shaped, flat body; a nucleus, eccentric; diameter, 350.7 μm ; clear increments of 126.

Moringuidae

Moringuidae sp. (TL: 31.3 mm)

Sagitta (Fig. 16-18a,b): transparent, circular, flat disk; a nucleus in the center; diameter, 52.0 μm ; unclear increments of 62.

Dysomatidae

Dysomatidae sp. (TL: 62.5 mm)

Sagitta (Fig. 16-19a,b): transparent, circular, flat disk; a nucleus, eccentric; diameter, 131.0 μm ; clear increments of 58.

Synaphobranchidae

Synaphobranchidae sp. (TL: 82.3 mm)

Sagitta (Fig. 16-20a,b): transparent, circular, flat disk; a nucleus in the center; diameter, 175.8 μm ; clear increments of 48 with some heavy checks.

Elopiformes

Elopidae

Megalops cyprinoides (TL: 24.3 mm)

Sagitta (Fig. 16-21a,b): transparent, oval, flat disk; a nucleus in the center; diameter, 98.6 μm ; clear increments of 20.

Table 8. Leptocephali used in this study.

Family	Genus	Species	Fish No.	Sampling St.	Date	TL (mm)
Anguillidae	Anguilla	japonica	6	31	Sep.11	40.5
Anguillidae	Anguilla	japonica	7	C-G7	Sep.23	43.1
Anguillidae	Anguilla	japonica	8	C-13	Sep.23	43.0
Anguillidae	Anguilla	japonica	9	C-14	Sep.23	42.7
Anguillidae	Anguilla	japonica	10	C-14	Sep.23	41.0
Anguillidae	Anguilla	japonica	11	C-15	Sep.23	43.4
Anguillidae	Anguilla	japonica	12	C-15	Sep.23	42.8
Anguillidae	Anguilla	japonica	13	C-15	Sep.23	41.8
Anguillidae	Anguilla	japonica	14	C-15	Sep.23	43.4
Anguillidae	Anguilla	japonica	15	C-15	Sep.23	44.0
Anguillidae	Anguilla	japonica	16	C-15	Sep.23	45.4
Anguillidae	Anguilla	japonica	17	C-15	Sep.23	45.9
Anguillidae	Anguilla	japonica	18	C-19	Sep.24	40.5
Anguillidae	Anguilla	japonica	19	C-19	Sep.24	47.0
Anguillidae	Anguilla	japonica	20	E-1	Sep.24	46.5
Anguillidae	Anguilla	japonica	21	E-2	Sep.25	44.8
Anguillidae	Anguilla	mar/cel	14	33	Sep.11	40.3
Congridae	Gnathophis	n.nystromi	4	22	Sep.06	25.5
Congridae	Gnathophis	n.nystromi	10	29	Sep.10	96.0
Congridae	Gnathophis	n.nystromi	15	33	Sep.11	53.0
Congridae	Gnathophis	n.nystromi	17	34	Sep.12	82.8
Congridae	Gnathophis	n.nystromi	28	CG	Sep.22	61.1
Congridae	Gnathophis	n.nystromi	34	C-11	Sep.23	57.3
Congridae	Gnathophis	n.ginanago	54	E-2	Sep.24	86.1
Congridae	Gnathophis	? xenica	8	24	Sep.07	42.7
Congridae	Gnathophis	? xenica	26	CG	Sep.22	40.0
Congridae	Gnathophis	? xenica	51	E-1	Sep.24	50.0
Congridae	Gnathophis	? xenica	52	E-1	Sep.24	54.2
Congridae	Gnathophis	? xenica	53	E-1	Sep.24	50.6
Congridae	Gnathophis	? xenica	55	E-3	Sep.25	54.0
Congridae	Gnathophis	? xenica	56	E-3	Sep.25	57.8
Congridae	Gnathophis	sp.	2	19	Sep.05	29.0
Congridae	Gnathophis	sp.	3	19	Sep.05	46.0
Congridae	Gnathophis	sp.	6	24	Sep.07	16.3
Congridae	Gnathophis	sp.	7	24	Sep.07	13.4
Congridae	Gnathophis	sp.	27	C-G6	Sep.27	45.8
Congridae	Ariosoma	Type I	1	16	Sep.04	150.0
Congridae	Ariosoma	Type I	5	22	Sep.07	85.8
Congridae	Ariosoma	Type III	21	B-4	Sep.13	194.0
Congridae	Ariosoma	Type III	22	B-4	Sep.13	219.3
Congridae	Ariosoma	Type III	24	33	Sep.11	249.0
Congridae	Ariosoma	Type III	29	C-G	Sep.22	307.2
Congridae	Ariosoma	Type C2	33	C	Sep.23	126.6
Congridae		sp.	30	C-G6	Sep.22	63.3
Muraenidae	Uropterygius	sp.	57	C-12	Sep.23	48.0
Muraenidae	Uropterygius	sp.	59	B-4	Sep.13	46.1
Muraenidae		sp.	9	26	Sep.08	62.0
Muraenidae		sp.	23	B-4	Sep.13	95.0
Ophichthidae		sp.	16	34	Sep.12	54.5
Ophichthidae		sp.	25	33	Sep.11	92.0
Ophichthidae		sp.	35	C-12	Sep.12	46.0
Ophichthidae		sp.	36	C-16	Sep.24	196.4
Xenocongridae		sp.	20	B-3	Sep.13	48.8
Nemichthyidae	Nemichthys	scolopaceus	18	B-3	Sep.13	206.7
Nettastomatidae		sp.	32	C	Sep.23	123.3
Moringuidae		sp.	19	B-3	Sep.13	31.3
Dysommatidae		sp.	13	32	Sep.11	62.5
Synaphobranchidae		sp.	12	32	Sep.11	82.3
Elopidae	Megalops	cyprinoides	58	34	Sep.12	24.3

Table 8. continued

TM	PAM	PAM/TM	Otolith size (μ m)	No.	Birth Date	Figure No.
			Diameter	Radius	Rings	
116	77	0.66	154.0	84.9	75	Jun. 28
117	78	0.67	148.2	84.1	74	Jul. 11
116	78	0.67	152.3	81.3	67	Jul. 18
115	78	0.68	160.0	88.7	78	Jul. 07
116	76	0.66	147.1	76.9	-	-
113	76	0.67	154.0	85.3	70	Jul. 15
116	78	0.67	154.2	85.2	70	Jul. 15
116	79	0.68	151.9	82.2	74	Jul. 11
114	78	0.68	161.2	87.8	70	Jul. 15
117	81	0.69	152.2	78.8	70	Jul. 15
115	77	0.67	149.2	82.1	70	Jul. 15
115	80	0.70	165.5	87.9	78	Jul. 07
116	78	0.67	147.9	85.7	72	Jul. 14
117	80	0.68	162.6	87.3	69	Jul. 17
114	77	0.68	145.2	76.8	-	-
116	79	0.68	151.9	81.7	69	Jul. 18
102	70	0.69	134.6	75.2	79	Jul. 24
121	101	0.83	49.0	25.8	30	Aug. 07
123	101	0.82	163.8	105.2	61	Jul. 11
120	101	0.84	89.2	55.2	48	Jul. 25
117	104	0.89	172.8	118.9	95	Jun. 09
115	95	0.83	127.9	86.2	90	Jun. 24
117	94	0.80	-	-	-	-
127	104	0.82	149.8	104.1	97	Jun. 19
152	122	0.80	89.0	40.0	51	Jul. 18
145	122	0.84	67.9	45.4	31	Aug. 22
143	119	0.83	85.2	61.5	62	Jul. 24
145	122	0.84	-	-	-	-
144	120	0.83	82.2	66.6	65	Jul. 21
147	122	0.83	86.2	58.5	64	Jul. 23
143	119	0.83	106.2	77.7	70	Jul. 17
132	108	0.82	61.8	38.8	36	Jul. 31
135	110	0.81	92.0	59.2	52	Jul. 15
137	103	0.75	-	19.0	-	-
136	83	0.61	34.3	18.0	16	Aug. 22
139	114	0.82	86.0	57.9	53	Aug. 05
119	109	0.92	85.8	45.0	-	-
119	109	0.92	58.4	26.6	-	-
149	64	0.43	430.0	225.0	-	-
148	65	0.44	422.0	232.0	-	-
147	104	0.71	202.5	230.8	-	-
150	141	0.94	101.5	51.5	-	-
156	142	0.91	95.4	52.5	-	-
166	92	0.55	124.2	72.1	57	Jul. 27
134	78	0.58	154.9	86.3	69	Jul. 16
124	67	0.54	258.6	155.9	111	May. 25
118	58	0.49	186.2	114.0	101	May. 30
142	74	0.52	93.7	54.8	39	Aug. 05
158	57	0.36	63.6	43.2	42	Aug. 01
153	73	0.48	223.0	138.0	133	May. 01
131	61	0.47	48.9	28.0	-	-
187	61	0.33	78.2	43.0	39	Aug. 16
126	46	0.37	137.2	101.9	81	Jun. 24
-	236	-	82.0	52.5	62	Jul. 13
227	57	0.25	350.7	227.2	126	May. 20
119	75	0.63	52.0	29.0	62	Jul. 13
130	60	0.46	131.0	82.7	58	Jul. 15
135	96	0.71	175.8	84.1	45	Jul. 28
68	53	0.78	98.6	52.8	20	Aug. 23
						16-21a.b

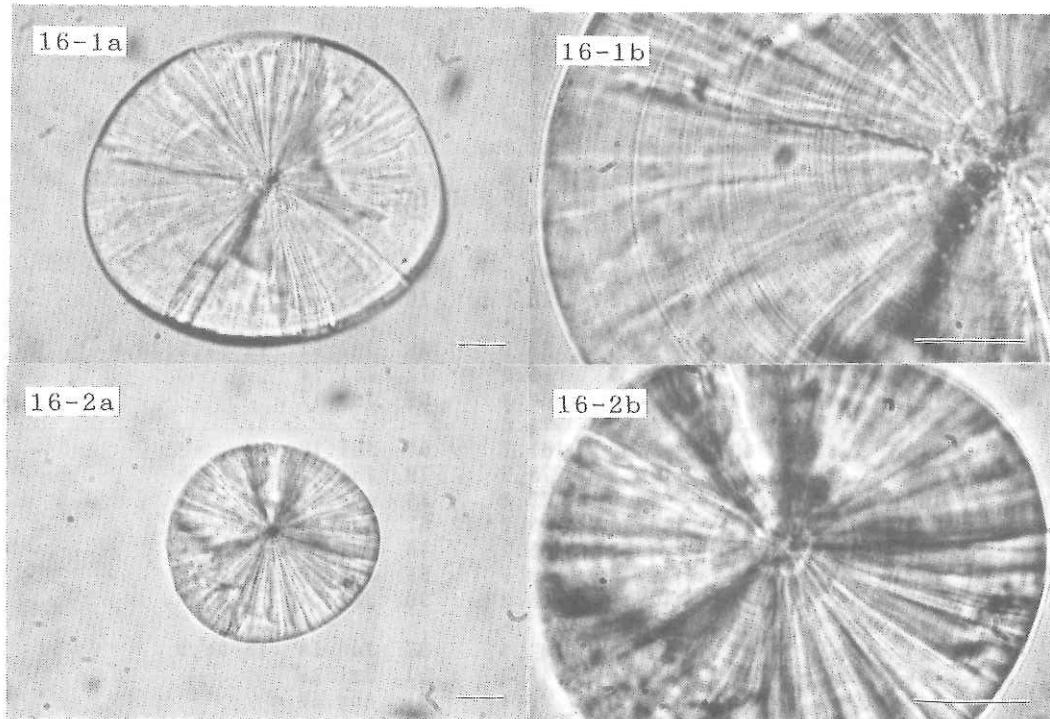


Fig. 16-1a,b Sagitta of *Anguilla japonica* (TL: 45.9 mm)

Fig. 16-2a,b Lapillus of *Anguilla japonica* (TL: 45.9 mm)

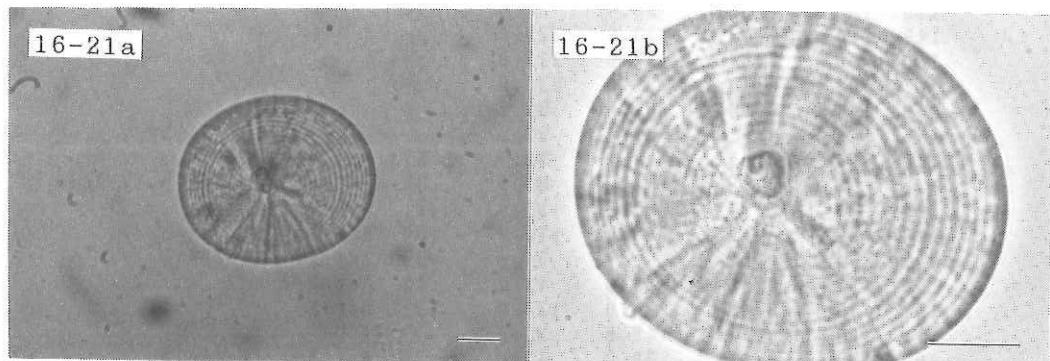


Fig. 16-21a,b Sagitta of *Megalops cyprinoides* (TL: 24.3 mm)

Fig. 16 Otoliths of leptocephali. Scale bar in photograph is 20 μm .

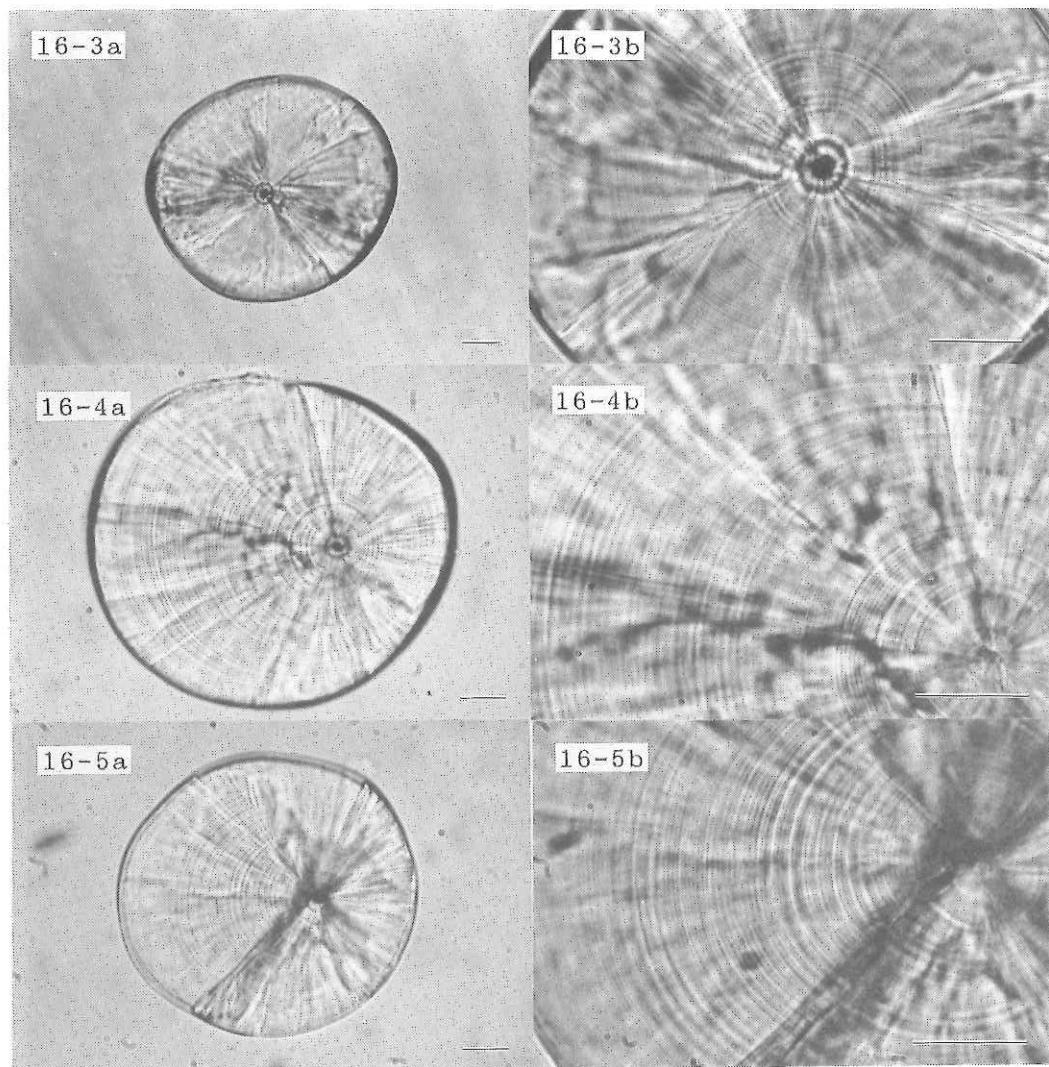


Fig. 16-3a,b Sagitta of Anguilla marmorata/celebesensis (TL: 41.3 mm)

Fig. 16-4a,b Sagitta of Gnathophis nystromi nystromi (TL: 82.8 mm)

Fig. 16-5a,b Sagitta of Gnathophis nystromi ginanago (TL: 86.1 mm)

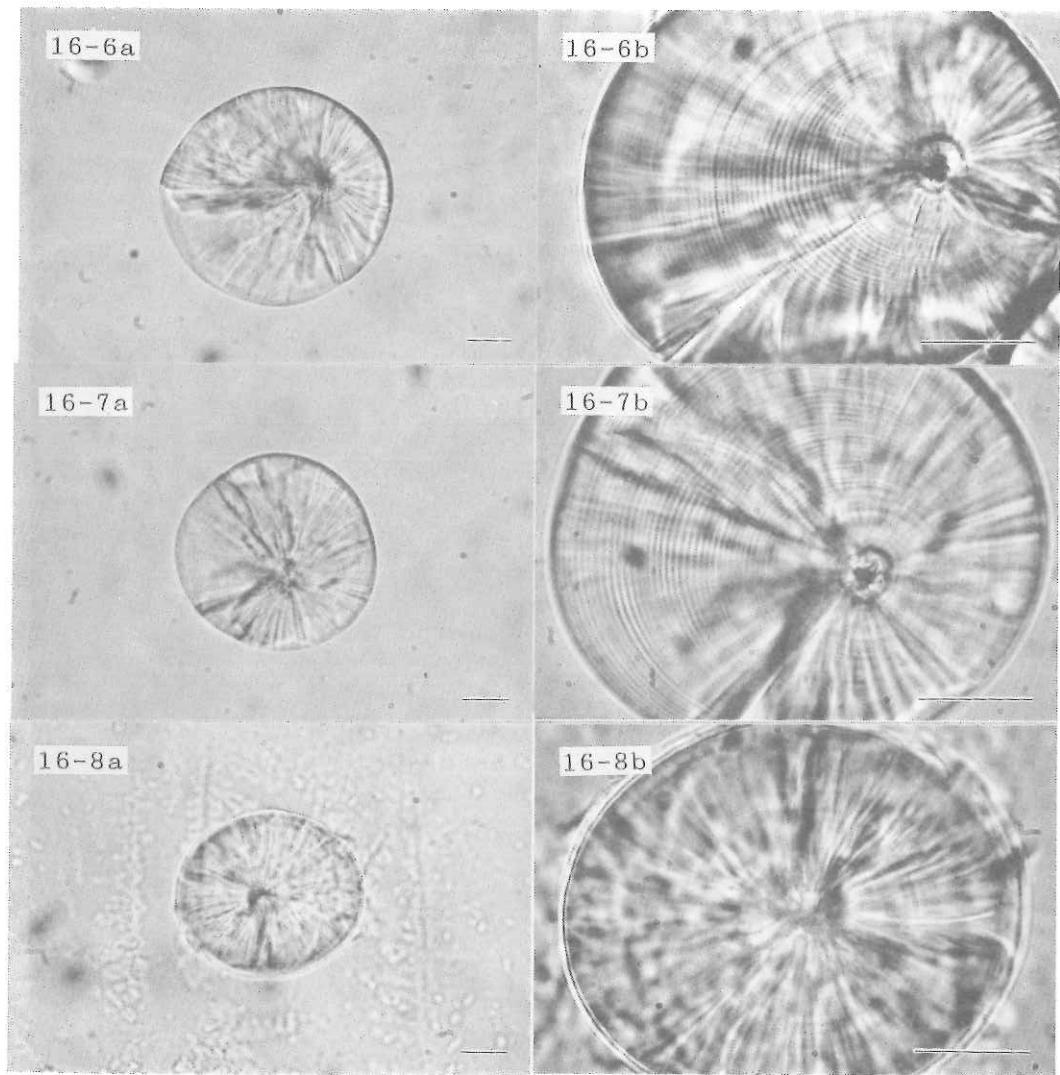


Fig. 16-6a,b Sagitta of Gnathophis ? xenica (TL: 57.8 mm)

Fig. 16-7a,b Sagitta of Gnathophis sp. (TL: 46.0 mm)

Fig. 16-8a,b Sagitta of Ariosoma Type I (TL: 150.0 mm)

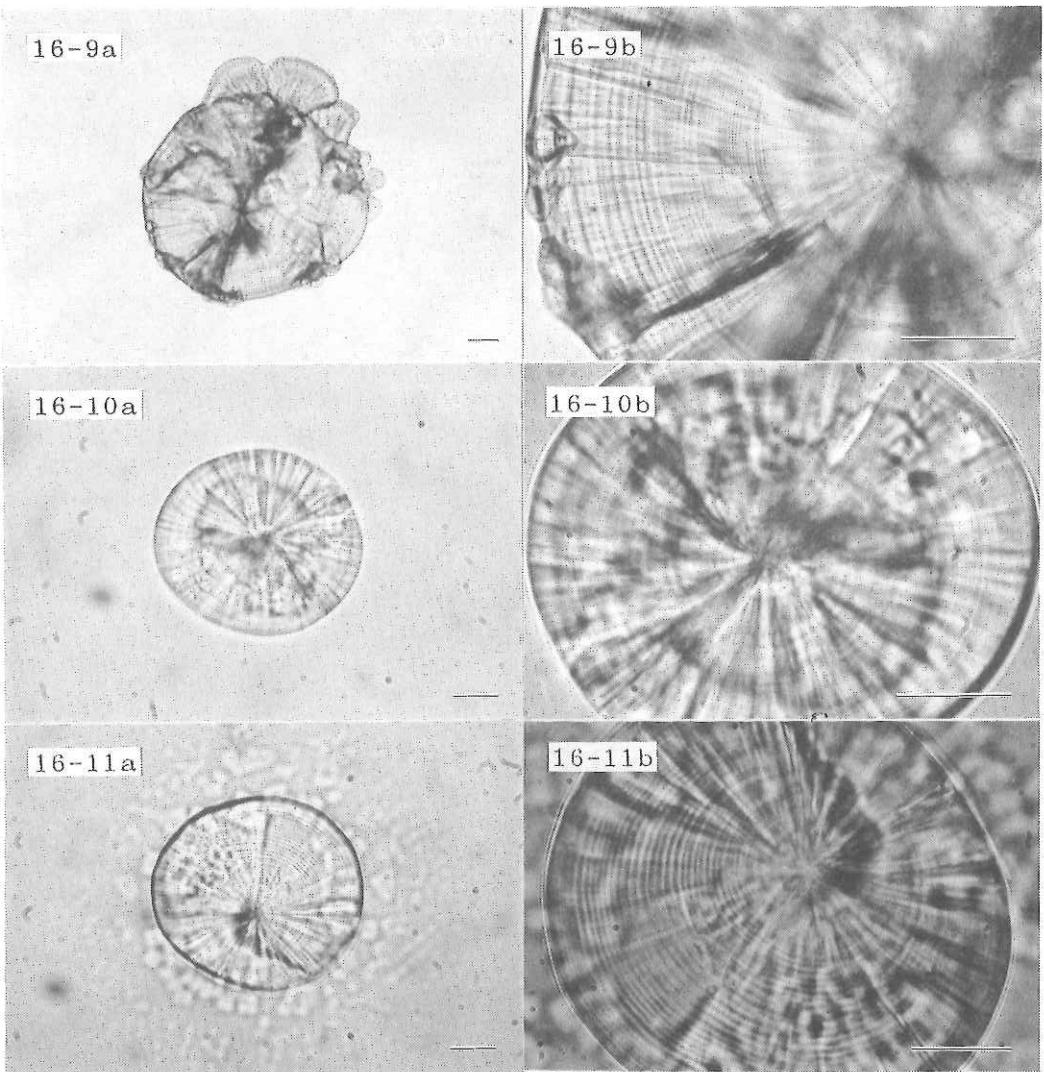


Fig. 16-9a,b Sagitta of Ariosoma Type III (TL: 219.3 mm)

Fig. 16-10a,b Sagitta of Ariosoma Type C2 (TL: 126.6 mm)

Fig. 16-11a,b Sagitta of Congridae sp. (TL: 63.3 mm)

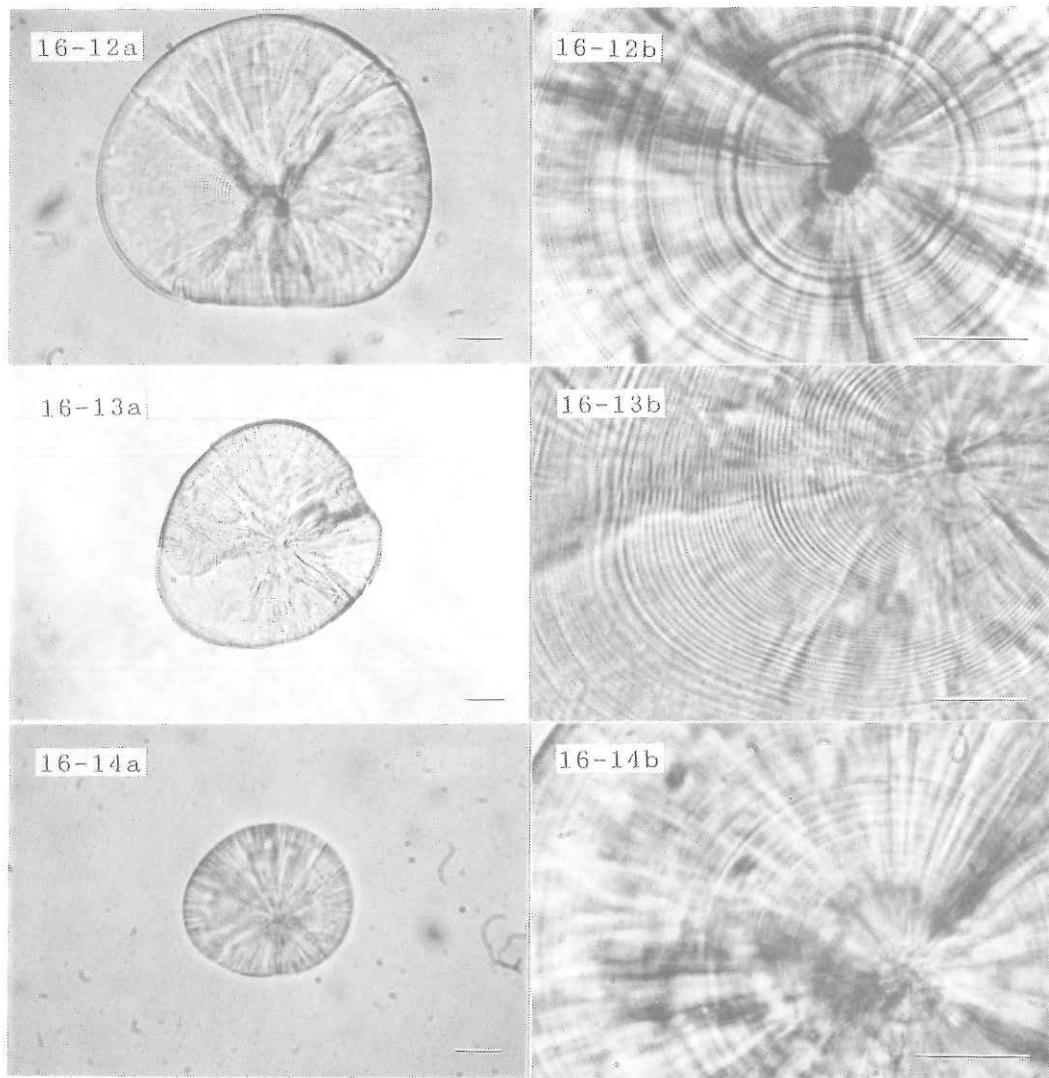


Fig. 16-12a,b Sagitta of Uropterygius sp. (TL: 48.0 mm)

Fig. 16-13a,b Sagitta of Muraenidae sp. (TL: 95.0 mm)

Fig. 16-14a,b Sagitta of Ophichthidae sp. (TL: 196.4 mm)

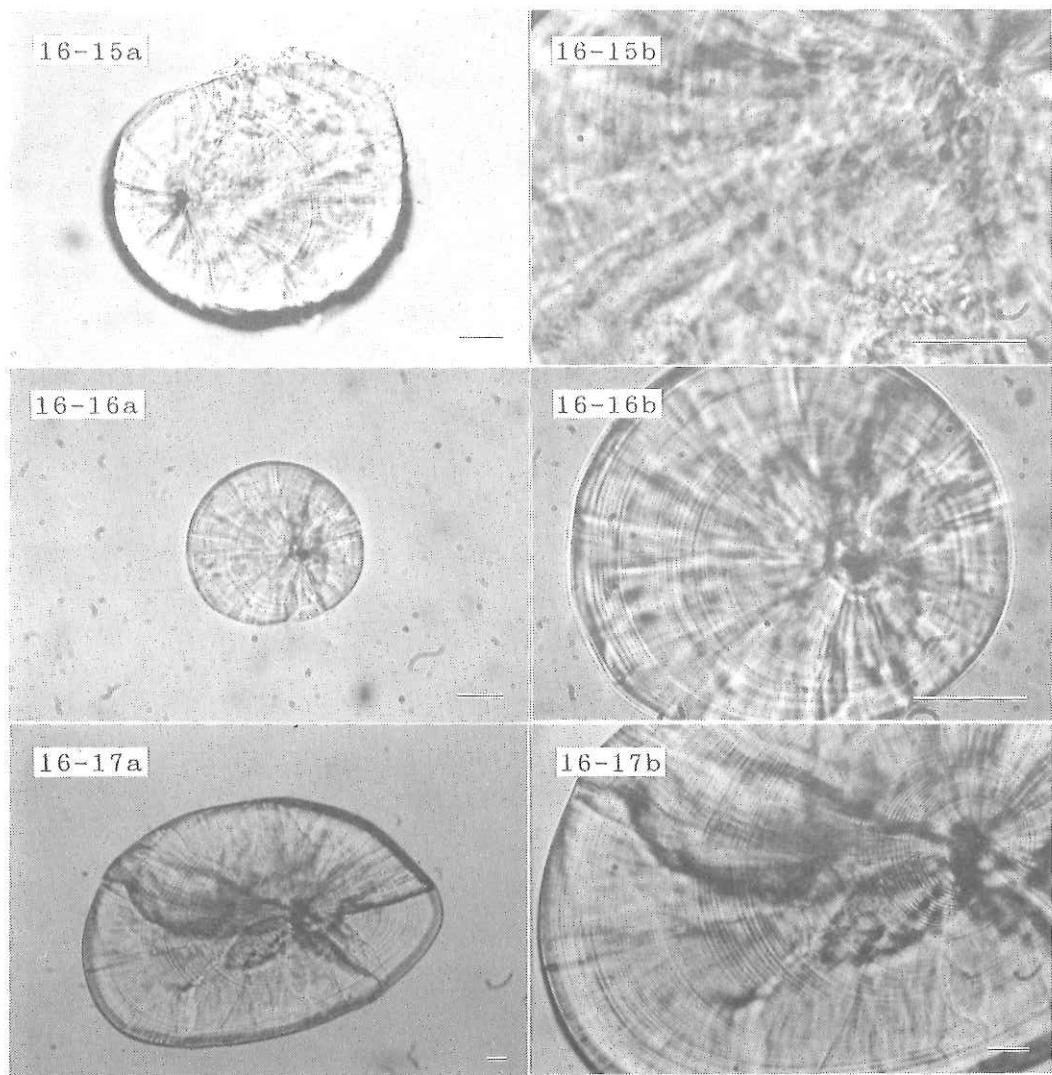


Fig. 16-15a,b Sagitta of Xenocongridae sp. (TL: 48.8 mm)

Fig. 16-16a,b Sagitta of Nemichthyidae sp. (TL: 206.7 mm)

Fig. 16-17a,b Sagitta of Nettastomatidae sp. (TL: 123.3 mm)

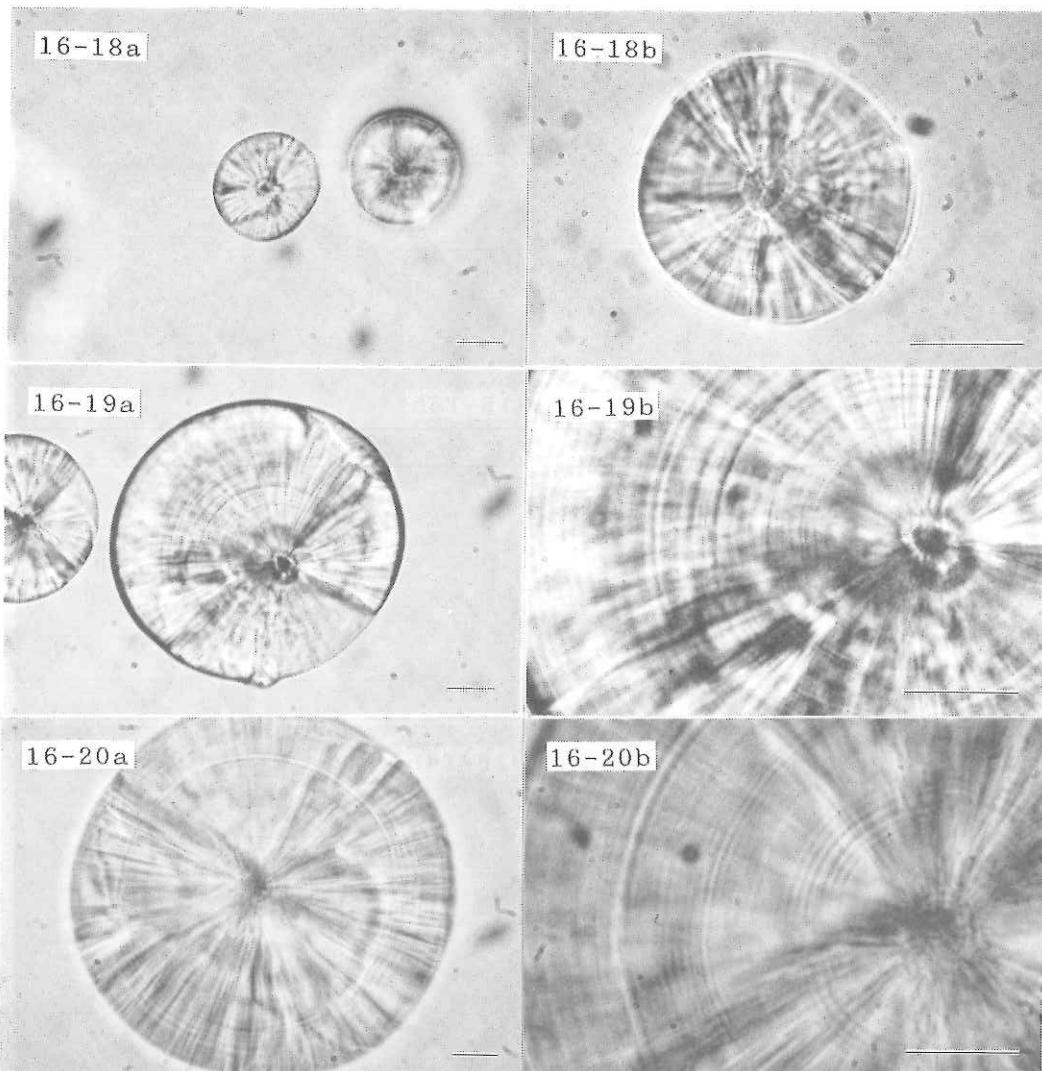


Fig. 16-18a,b Sagitta of Moringuidae sp. (TL: 31.3 mm)

Fig. 16-19a,b Sagitta of Dysommatidae sp. (TL: 62.5 mm)

Fig. 16-20a,b Sagitta of Synaphobranchidae sp. (TL: 82.3 mm)

8. Otolith-tagging of leptocephali with fluorescent substance, alizarin complexon

Katsumi Tsukamoto and Akima Umezawa

In order to determine the possibility of otolith-tagging of leptocephali with fluorescent substance, and to validate otolith growth increments of leptocephali, marking experiments were conducted for three specimens collected during the cruise. One individual of ophichthidae sp. and two of muraenidae sp. were immersed in 75 or 100 mg/l solution of alizarin complexon (ALC) for 4-14 hours, and were kept for 1-12 days afterwards (Table 9). Fluorescent mark on otoliths were examined under UV light and the number of increments outside ALC mark were counted in a successfully marked fish.

One specimen of Uropterygius sp., Muraenidae, was successful and a red fluorescent band was found near the edge of sagittal otolith (Fig. 17-1a,b). A distinct check (dark discontinuous zone) was formed at the same layer with the mark, suggesting the check formation corresponding to the stress of marking treatment. Four faint, narrow increments were observed outside ALC mark, but its number disaccorded with the days after ALC treatment (12 days). The cessation of increment formation may occurred from the stress of marking treatment. Marking of other two individuals were unsuccessful. However, one of them, Uropterygius sp., formed a check at the otolith edge which also appeared to be derived from the stress of handling (Fig. 17-2a,b).

We confirmed, at least, the availability of otolith-tagging with ALC to leptocephalus as well as other marine fish larvae. However, the validation of the otolith increments was not completed. Fish condition and the control of the environmental factors during the experiment seemed to hold the key for the problem.

Table 9 Marking experiment of leptocephali conducted during the cruise, KH86-4.

Fish	<u>Ophichthidae</u> sp.	<u>Uropterygius</u> sp.	<u>Uropterygius</u> sp.
Fish No.	25	59	57
Sampling Date	Sep 11	Sep 13	Sep 23
Locality	33	B4	C12
Exp. Date	Sep 12-13	Sep 12-27	Sep 23-26
TL (mm)	92.0	46.1	48.0
ALC treatment			
duration (hr)	7.8	14	4.6
conc. (mg/l)	100	75	100
WT (°C)	28.7	24.0	26.5
Rearing duration after marking (day)	1	15	3
Fluorescent mark	no	yes	no
Check ring	no	yes	yes
No. increments outside the mark and/or check	0	4	1

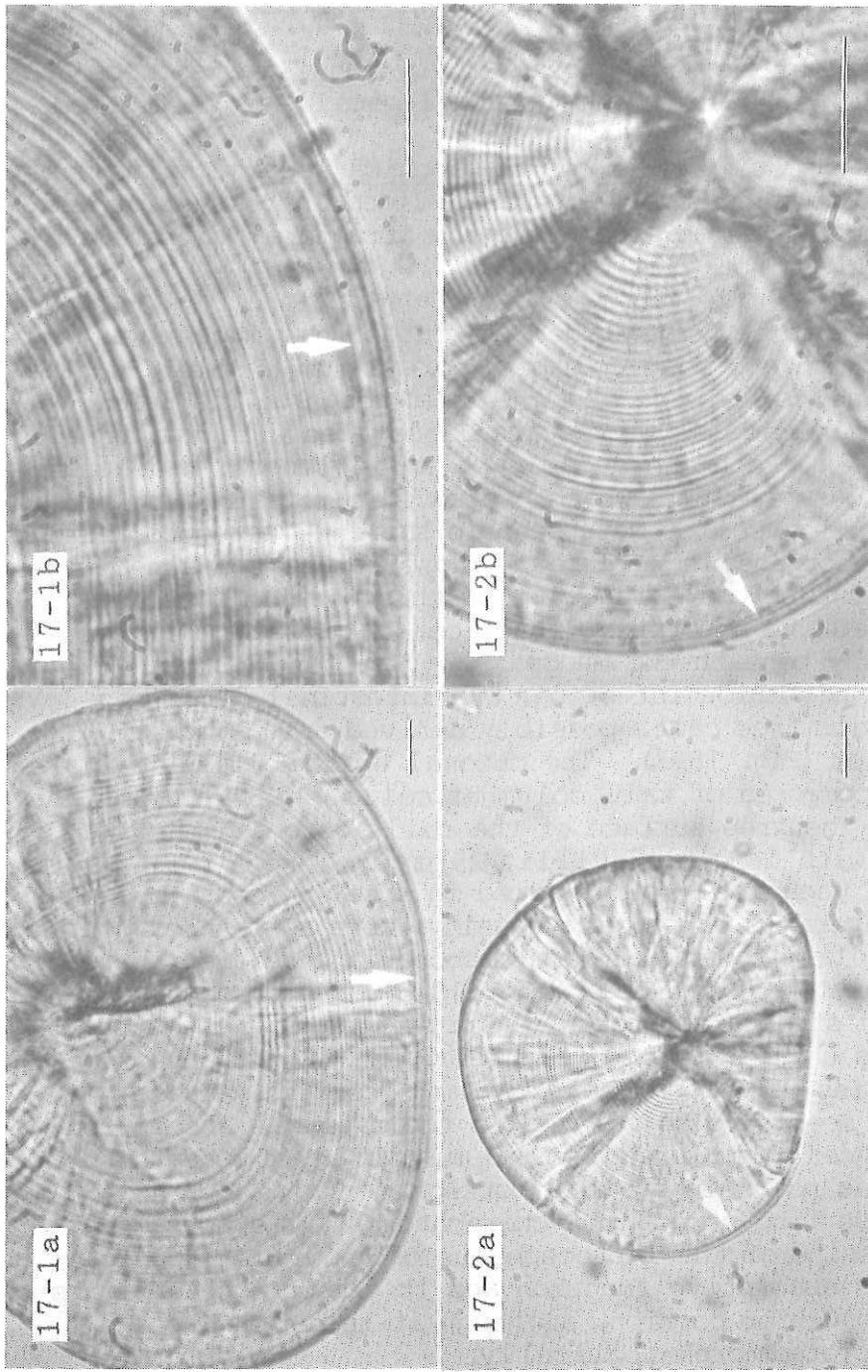


Fig. 17 Otoliths of leptocephali treated with ALC. Scale bar is 20 μ m.
 1a, b: *Uropterygius* sp. (Fish No. 59) marked successfully.
 Arrow indicates the check corresponding to the red fluorescence.
 2a, b: *Uropterygius* sp. (Fish No. 57) marked unsuccessfully,
 but with clear check corresponding to the timing of treatment.

9. Fine structure of intestinal epithelium of the eel
leptocephalus *Anguilla japonica*

Tsuguo Otake and Takeshi Kajihara

Intestines of 3 leptocephali of *Anguilla japonica* (TL : 37.7, 44.0, 47.7 mm) were morphologically investigated.

The intestine of *Anguilla japonica* leptocephalus was a simple straight tube. It was divided into anterior and posterior halves on account of the structural difference of the intestinal epithelium.

The anterior intestine: The intestinal mucosa was covered with a simple columner epithelium (Fig. 18-1). The epithelial cells were about 5 μm in height. The free surface of the cells were sparcely covered with microvilli (Fig. 18-2). Each microvillus, 1 μm in length, had long filamentous materials which projected radically from the tip. Small vacuoles were seen in supranuclear cytoplasm, but other organella were few. Those structural aspects suggested that the epithelium of this portion does not have an active absorptive function. A circular muscle layers lay beneath the mucosa.

The posterior intestine: The intestinal lumen was filled with free cells possibly derived from intestinal epithelium (Fig. 18-3). The mucosal epithelium was simple and was composed of tall columner cells, 17.5 - 50 μm in height. The free surface of the cells were densely covered with long microvilli, 25 μm in length (Fig. 18-4). Numerous vacuoles, which varied in size and contained small materials of varying density, were seen throughout the cytoplasm. Many large mitochondria were distributed basal portion of the cell (Fig. 18-5). Membranous lamellar structures presented arround the mitochondria, which was the remarkable feature of the cells. Lysosome like bodies were found near the mitochondria. These features seemed to be related to the material absorption and intracellular digestion. A muscle layer beneath the mucosa was not seen in this portion.

Those fine structural characateristics suggest that the intestine of the leptocephalus of *Anguilla japonica* possesses absorptive function and it can uptake nutrients in the posterior portion, although it is not fully differentiated morphologilcally.

Food organisms were not found in the intestines examined in the present study.

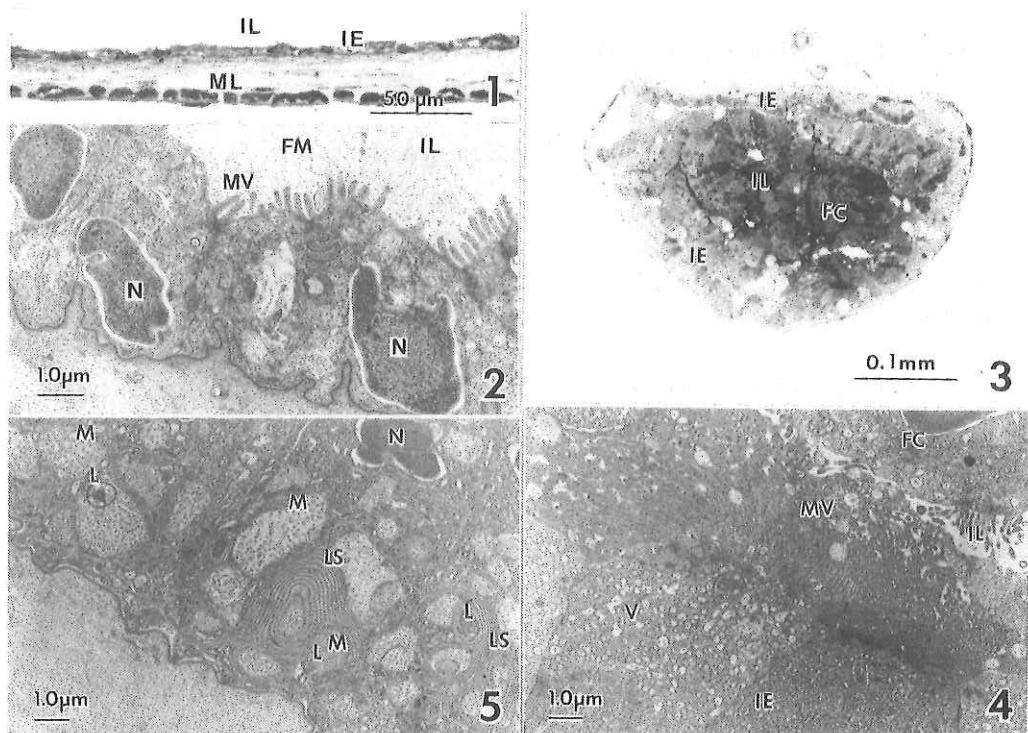


Fig.18-1 Longitudinal section through the anterior intestine.

Fig.18-2 Longitudinal section through the epithelium of the anterior intestine.

Fig.18-3 Transverse section through the posterior intestine.

Fig.18-4 Section through the apical portion of the epithelium in the posterior intestine, showing the microvilli(MV) and vacuoles(V).

Fig.18-5 Section through the basal portion of the epithelial cells in the posterior intestine, showing mitochondria(M) and membranous lamella structures(LS).

IL,intestinal lumen; IE,intestinal epithelium; ML,circular muscle layer;
MV,microvilli; FM,filamentous material; FC,free cell; V,vacuole;
M,mitochondria; LS,membranous lamella structure; L,lysosome like body

10. Studies on the eyes and luminous organs in some deep-sea fishes

Hiroaki Somiya

Four kinds of deep-sea fishes which showed remarkable specializations in the eyes were collected during the present cruise.

- 1) Evermannella indica, St. 4, IKMT, body length : 9 cm.

The eyes of the fish are tubular and the lenses are bright yellow. Bacterial luminous organ is observed in the ventral site of the body. Electron microscopic observation of the retina and the luminous organ, and chemical examination of the visual pigments are under examination.

- 2) Benthalbella infans, St. A, IKMT, body length : 9 cm.

The eyes are tubular and the yellow lenses are also found in the eyes.

- 3) Dolichoptervx sp., Sts. 5, 11, 12, 20, body length : ca. 6 cm.

The eyes are tubular but the lenses are non-pigmented (colourless). The retinal diverticula were found. Electron microscopic observation of the retinal diverticula are under examination.

- 4) Larva of Idiacanthus sp., Sts. 7, 9, 18, 24, 32, 33.

Ten larvae of Idiacanthus sp. that has stalked eyes were sampled. Eyes were fixed for the electron microscopic observation. The morphometric study of the eye is under examination.

11. List of gonostomatid fish larvae

Takakazu Ozawa, Shohei Okamoto,
and Abellino B. Corpuz

IKMT samples included very abundant fish larvae. Due to shortage of time, we could not identify all of them. List presented below is for the gonostomatid fish larvae collected with IKMT net in Leg 1 excluding Sts. 29, 30 and B. In it, one set of data (station, no. of specimens, and range of standard length in mm) is separated by semicolon.

Vinciguerria nimbaria

1, 105, 6.0-16.8 ; 2, 93, 3.8-14.6 ; 3, 605, 4.0-16.2 ; 4, 393, 4.8-17.2 ; 5, 29, 4.2-13.5 ; 6, 681, 3.5-14.3 ; 7, 639, 3.0-14.6 ; 8, 133, 4.5-14.3 ; 9, 770, 5.2-13.2 ; 10, 485, 4.7-13.6 ; 11, 229, 4.8-13.0 ; A, 114, 5.2-13.0 ; 12,, 76, 4.5-13.0 ; 13, 175, 5.2-13.3 ; 14, 371, 3.8-13.0 ; 15, 378, 3.3-13.0 ; 16, 408, 4.1-13.9 ; 17, 377, 5.2-13.7 ; 18, 232, 4.8-13.7 ; 19, 617, 4.3-14.2 ; 20, 163, 4.1-13.2 ; 21, 246, 4.2-13.4 ; 22, 873, 5.7-13.6 ; 23, 333, 4.3-13.5 ; 24, 1247, 2.9-13.00 ; 25, 537, 4.1-13.0 ; 26, 150, 3.6-13.5 ; 27, 782, 3.2-14.5 ; 28, 212, 3.8-14.2 ; 31, 449, 2.7-14.5 ; 32, 261, 3.6-14.3 ; 33, 820, 4.3-14.2 ; 34, 210, 5.8-14.5

Vinciguerria attenuata

2, 51, 5.2-9.5 ; 3, 160, 4.6-9.0 ; 4, 53, 6.1-9.3 ; 5, 7, 5.2-8.8 ; 6, 200, 5.0-11.2 ; 7, 331, 4.3-8.5 ; 8, 36, 5.2-8.1 ; 9, 300, 4.5-8.6 ; 10, 11, 5.2-7.4 ; 11, 80, 5.8-9.2 ; 12, 6, 5.3-7.1 ; 13, 37, 5.7-7.3 ; 14, 53, 5.1-6.5 ; 15, 80, 4.3-7.6 ; 16, 55, 4.8-8.7 ; 17, 25, 5.5-7.3 ; 18, 28, 4.5-9.1 ; 19, 39, 5.1-8.7 ; 20, 7, 5.3-15.0 ; 21, 3, 6.9-13.7 ; 22, 16, 5.5-14.3 ; 24, 126, 4.3-15.6 ; 25, 82, 5.5-7.0 ; 26, 13, 4.3-6.8 ; 27, 313, 5.3-8.2 ; 28, 14, 5.0-6.5 ; 31, 47, 4.0-7.2 ; 32, 37, 5.2-7.6 ; 33, 22, 5.5-8.1.

Cyclothona alba

1, 14, 6.0-11.2 ; 2, 118, 3.8-10.8 ; 3, 50, 3.8-9.5 ; 4, 760, 3.8-12.2 ; 5, 243, 4.3-10.2 ; 6, 553, 3.2-10.2 ; 7, 461, 3.5-11.8 ; 8, 58, 3.2-9.7 ; 9, 199, 3.7-10.4 ; 10, 430, 4.1-11.2 ; 11, 217, 3.8-11.0 ; A, 119, 6.0-12.0 ; 12, 58, 2.8-10.2 ; 13, 305, 3.6-11.0 ; 14, 100, 4.1-12.0 ; 15, 172, 3.3-10.8 ; 16, 276, 3.9-10.5 ; 17, 182, 5.5-11.1 ; 18, 168, 4.4-9.5 ; 19, 654, 4.3-10.9 ; 20, 90, 4.2-10.1 ; 21, 604, 3.4-10.9 ; 22, 1186, 4.0-11.0 ; 23, 186, 3.4-10.9 ; 24, 1311, 3.2-10.2 ; 25, 1371, 3.0-11.0 ; 26, 278, 2.5-10.7 ; 27, 341, 3.2-10.4 ; 28, 317, 2.5-10.8 ; 31, 776, 2.3-12.1 ; 32, 176, 3.8-10.5 ; 33, 530, 4.3-11.3 ; 34, 168, 4.6-11.0.

Cyclothona pseudopallida

1, 5, 11.0-14.5 ; 2, 7, 5.0-7.5 ; 3, 3, 7.0 ; 4, 12, 7.5-12.5 ; 5, 4, 8.2-11.5 ; 6, 25, 5.8-12.3 ; 7, 4, 7.5-12.5 ; 8, 2, 6.3-10.5 ; 9, 63, 7.1-12.5 ; 10, 12, 5.3-13.2 ; 11, 7, 7.3-12.5 ; A, 3, 6.2-9.3 ; 12, 5, 6.8-10.1 ; 13, 22, 5.7-12.1 ; 14, 5, 5.6-11.2 ; 15, 11, 5.0-9.7 ; 16, 5, 7.2-10.8 ; 17, 12, 7.8-11.6 ; 18, 15, 6.5-10.2 ; 19, 8, 8.6-12.2 ; 20, 6, 6.6-9.7 ; 21, 57, 5.9-11.6 ; 22, 38, 5.9-12.7 ; 23, 3, 5.6-11.1 ; 24, 27, 6.2-10.4 ; 25, 36, 7.4-12.3 ; 26, 9, 6.4-11.1 ; 27, 14, 6.3-10.8 ; 28, 2, 6.9-10.5 ; 31, 2, 8.5-10.6 ; 32, 16, 8.3-12.2 ; 33, 9, 6.8-11.2 ; 34, 23, 5.8-11.2.

Cyclothona palilda

7, 1, 13.1 ; A, 5, 8.5-10.8 ; 12, 5, 8.0-13.5 ; 28, 1, 12.1 ; 34, 3, 12.4-15.2.

Cyclothona acclinidens

2, 1, 3.0 ; 4, 1, 5.8 ; 10, 2, 10.6-12.5 ; 13, 1, 5.9 ; 24, 2, 4.3-8.4 ; 25, 3, 3.1-4.6 ; 32, 2, 5.3-7.6.

Cyclothona atraria

4, 1, 9.7 ; 9, 1, 14.0 ; 10, 5, 7.7-10.8 ; 11, 1, 9.8 ; A, 2, 8.7-9.5 ; 12, 1, 10.2 ; 14, 1, 7.8 ; 21, 3, 11.2 ; 23, 2, 8.9-10.5 ; 25, 2, 8.0-8.2 ; 26, 1, 8.4 ; 28, 1, 10.6 ; 33, 1, 8.0 ; 34, 6, 7.8-10.4.

Cyclothona sp. 1

6, 1, 9.1 ; 7, 1, 8.3

Diplophos taenia

2, 2, 19.2-45.5 ; 3, 1, 32.8 ; 4, 3, 7.8-33.2 ; 6, 11, 9.0-46.0 ;
7, 4, 19.3-42.5 ; 8, 1, 14.1 ; 9, 25, 8.6-44.1 ; 10, 4, 11.3-44.2 ; 11, 5, 14.2-16.8 ; A, 3, 37.3 ; 12, 2, 25.8 ;
13, 9, 11.9-39.4 ; 14, 3, 16.7-17.2 ; 15, 15, 5.3-30.8 ;
16, 2, 5.8-22.7 ; 17, 1, 33.7 ; 19, 2, 19.2-39.5 ; 20, 5, 7.2-26.4 ; 21, 1, 36.2 ; 23, 1, 7.4 ; 24, 11, 5.2-34.3 ;
25, 6, 6.0-38.5 ; 26, 5, 5.0-13.4 ; 27, 10, 5.1-15.8 ; 28, 2, 12.1 ; 31, 6, 7.3-20.1 ; 32, 3, 9.1-33.2 ; 33, 3, 10.4-27.3.

Diplophos orientalis

20, 2, 12.8-15.2 ; 22, 3, 11.3-22.4 ; 23, 1, 11.8 ; 27, 1, 21.3 ; 33, 1, 16.2.

Diplophos greyae

21, 1, 14.9.

Pollichthys mauli

2, 5, 5.2-7.3 ; 4, 2, 6.2-7.3 ; 5, 1, 5.8 ; 7, 2, 7.0 ;
32, 2, 9.5-13.3 ; 33, 2, 7.5-14.4 ; 34, 1, 9.6.

Gonostoma gracile

2, 1, 8.3 ; 3, 1, 8.6 ; 4, 7, 5.6-7.2 ; 5, 2, 5.5 ; 7, 2, 5.2-7.1 ; 11, 1, 13.3 ; 18, 6, 5.8-8.6 ; 21, 1, 8.0 ; 22, 19, 7.1-10.4 ; 23, 55, 4.2-10.5 ; 24, 82, 3.2-8.2 ; 25, 192, 3.8-7.2 ; 26, 7, 4.3-7.2 ; 27, 145, 2.8-6.8 ; 28, 6, 4.2-7.2 ; 31, 27, 4.1-7.4 ; 33, 27, 4.3-9.8 ; 34, 14, 4.9-9.2.

Gonostoma elongatum

3, 2, 8.3 ; 12, 3, 7.0- 10.3 ; 13, 9, 4.3-9.2 ; 14, 3, 4.5-5.7 ; 15, 12, 4.2-7.3 ; 16, 17, 4.6-8.3 ; 17, 9, 4.2-9.2 ; 18, 21, 7.3-9.6 ; 19, 5, 5.8-14.0 ; 20, 23, 4.4-13.5 ; 22, 10, 5.4-10.5 ; 23, 4, 6.9-10.6 ; 24, 15, 5.5-14.2 ; 25, 4, 6.0-9.6 ; 26, 2, 7.5-8.3 ; 27, 5, 5.7-9.4 ; 28, 1, 7.0 ; 31, 2, 8.7-9.1 ; 33, 3, 8.2-12.3 ; 34, 2, 8.2-10.2.

Gonostoma atlanticum

6, 1, 8.2 ; 7, 16, 5.5-9.1 ; 9, 2, 8.0-8.2 ; 11, 1, 10.2 ; A, 3, 7.8- 12.5 ; 12, 12, 5.6-12.4 ; 13, 11, 6.1-8.4 ; 14, 4, 5.6-9.5 ; 15, 19, 4.8-7.8 ; 16, 3, 5.4-9.1 ; 17, 1, 10.8 ; 18, 4, 7.3-15.3 ; 20, 1, 9.5 ; 23, 10, 5.3-16.0 ; 24, 4, 3.5-17.2 ; 25, 6, 7.1-9.1 ; 27, 7, 3.9-11.2 ; 28, 1, 5.4 ; 31, 8, 3.5-8.2 ; 32, 7, 6.5-7.6 ; 33, 10, 5.3-8.5 ; 34, 1, 7.9.

Woodsia nonsuchae

5, 1, 6.3.

Margrethia obtusirostra

25, 6, 6.1-8.2 ; 26, 1, 7.5 ; 27, 6, 6.0-8.5 ; 34, 1, 15.8.

Valenciennellustripunctulatus

2, 1, 25.3 ; 6, 1, 17.8 ; 17, 1, 19.5 ; 21, 3, 20.5-27.5 ; 24, 2, 15.2-17.8.

Gonostomatidae spp. (Broken) (Standard length not measured)

1, 3 ; 3, 3 ; 4, 7 ; 6, 15 ; 7, 2 ; 8, 2 ; 9, 16 ; 10, 1 ; A, 1 ; 13, 1 ; 14, 2 ; 15, 12 ; 16, 4 ; 19, 1 ; 21, 1 ; 22, 4 ; 23, 6 ; 24, 11 ; 25, 14 ; 26, 8 ; 27, 19 ; 28, 1 ; 32, 2 ; 33, 1 ; 34, 1.

12. Preliminary survey on the identification,
systematics and spatial distribution
of percoid larvae

Yoshinobu Konishi

A total of 781 specimens of percoid larvae and juveniles except apogonid, carangid, chaetodontid, pomacanthid, labrid and scarid in 41 ichthyoplankton samples of IKMT and Hexagon nets from St. 5 to St. B in Leg. 1 were somewhat roughly sorted on R.V. Hakuho Maru and identified in my laboratory later.

Table 10 shows the list of larvae and juveniles excluding 19 unidentified specimens. The family, genus and species names, and their arrangement were dependent on "The Fishes of the Japanese Archipelago" published by Tokai Univ. Press in 1984. One third (33.4 %) of the total number of larvae and juveniles belonged to anthiinae and 14.3 % belonged to lutjanidae, and these two groups occupied near one half of total specimens. The number of specimens and genera caught per haul were more abundant at St. 33, St. 34 and St. B than those at the other stations. A Pseudanthias sp. and Pseudogramma polyacantha were distributed to the nearly entire sea water observed.

Table 10-1. Number of specimens of percoid larvae and juveniles in KH-86-4.

Species	No. of St. and net	5 IK	6 IK	7 IK	8 IK	10 IK	A IK	12 IK	13 IK	14 IK	15 IK	16 IK
Percichthyidae												
<i>Synagrops japonicus</i>		1	1	1	1	2				1		
<i>Malakichthys</i> sp.												
Serranidae												
<i>Cephalopholis</i> sp.												
<i>Epinephelinae</i> spp.												
<i>Lioplopoma maculatum</i>												
<i>Plectranthias</i> spp.			1									
<i>Caprodon schlegelii</i>												
<i>Odontanthias</i> sp.												
<i>Holanthias</i> spp.												
<i>Tosanoides</i> sp.?												
<i>Pseudanthias</i> spp.		2							6	1		
<i>Mirolabrichthys</i> spp.												
<i>Anthiinae</i> spp.		1	1				1		1	1		
<i>Grammatonotus</i> sp.												
Symphsanodontidae									1			
<i>Symphsanodon</i> sp.												
Grammatidae												
<i>Gramistes sexlineatus</i>		1	1				2	1	2			
Pseudogrammidae												
<i>Pseudogramma polyacantha</i>		3								1		2
Priacanthidae												
<i>Pristigenys</i> sp.												
<i>Priacanthidae</i> spp.												
Malacanthidae												
<i>Malacanthus brevirostris</i>												
<i>Hoplolatilus cuniculus</i> ?												
<i>H. fronticinctus</i>												
Coryphaenidae								2				
<i>Coryphaena equiselis</i>												
<i>C. hippurus</i>												
<i>C. equiselis/C. hippurus</i>												
Menidae												
<i>Mene maculata</i>												
Leiognathidae												
<i>Leiognathus</i> sp.												
Bramidae												
<i>Brama japonica</i>		1										
<i>B. orcinus</i> ?												
<i>Taractes asper</i>												
<i>Pterycombus petersii</i>												
Bramidae spp.						3		1				
Caristiidae												
<i>Caristius macropus</i>												
Emmelichthyidae												
<i>Erythrocles schlegelii</i>												
<i>Erythrocles</i> sp.												
Sciaenidae												
<i>Sciaenidae</i> sp.												
Mullidae												
<i>Mullidae</i> sp.												
Lutjanidae												
<i>Etelis</i> sp.												
<i>Paracasio</i> sp.		1										
<i>Etelinae</i> spp.												
<i>Lutjanus</i> spp.												
<i>Caesio tile</i>												
<i>Caesioninae</i> spp.												
<i>Lutjanidae</i> spp.												
Lethrinidae												
<i>Lethrinus</i> spp.												
<i>Lethrinidae</i> spp.												
Pomacentridae												
<i>Abudefduf coeruleopunctatus</i>		1										
<i>Pomacentridae</i> spp.												
Cirrhitidae												
<i>Cyprinocirrhites polyactis</i>			1									
<i>Cirrhitichthys</i> sp.												
<i>Cirrhitidae</i> spp.												
Champsodontidae												
<i>Champsodon</i> sp.		1										
Chiasmodontidae												
<i>Pseudoscolexus scriptus sakamianus</i>									1			
<i>Pseudoscolexus</i> sp.										1		
Ammodytidae												
<i>Embolichthys mitsukurii</i>												
<i>Ammodytidae</i> sp.?												
T O T A L		13	7	5	2	2	8	7	6	3	2	4

IK; IKPT Net, HE; Hexagon Net

Apogonidae, Carangidae, Chaetodontidae, Pomacanthidae, Labridae and Scaridae excluded.

Table 10-2. Continued

Species	No. of St. and net	17 IK	18 IK	19 IK	20 IK	21 IK	22 IK	23 IK	24 IK	25 IK	27 IK	28 IK
Percichthyidae								1				
<i>Synagrops japonicus</i>												1
<i>Malakichthys</i> sp.												
Serranidae												
<i>Cephalopholis</i> sp.												
<i>Epinephelinae</i> spp.												
<i>Lioloponoma maculatum</i>												
<i>Plectranthias</i> spp.					1							
<i>Caprodon schlegelii</i>												
<i>Odontanthias</i> sp.												
<i>Holanthias</i> spp.												
<i>Tosanoides</i> sp.?												
<i>Pseudanthias</i> spp.							3	2	3	4	14	14
<i>Mirolabrichthys</i> spp.												1
<i>Anthiinae</i> spp.												
<i>Grammatonotus</i> sp.					1	1	2	1	1	1	1	1
Syphyanodontidae												
<i>Syphyanodon</i> sp.							1			1	2	
Grammistidae												
<i>Grammistes sexlineatus</i>												
Pseudogrammidae												
<i>Pseudogramma polycantha</i>		1		2	4				2	1		1
Priacanthidae												
<i>Pristigenys</i> sp.							1	1				
Priacanthidae spp.												
Malacanthidae												
<i>Malacanthus brevirostris</i>								1				
<i>Hoplostilus cuniculus</i> ?								1				
<i>H. fronticinctus</i>								1	1	1	1	1
Coryphaenidae												
<i>Coryphaena equiselis</i>												
<i>C. hippurus</i>												
<i>C. equiselis/C. hippurus</i>												
Menidae												
<i>Mene maculata</i>												
Leiognathidae												
<i>Leiognathus</i> sp.												
Bramidae												
<i>Brama japonica</i>												
<i>B. orcinii?</i>								1				
<i>Taractes asper</i>												
<i>Pterycombus petersii</i>								1	2	1		
Bramidae spp.								3		1		
Caristidae												
<i>Caristius macropodus</i>							1					
Emmelichthyidae												
<i>Erythrocles schlegelii</i>												
<i>Erythrocles</i> sp.												
Sciaenidae												
<i>Sciaenidae</i> sp.												
Nullidae												
<i>Nullidae</i> sp.												
Lutjanidae												
<i>Etelis</i> sp.												
<i>Paracaelio</i> sp.												
<i>Etelinae</i> spp.												
<i>Lutjanus</i> spp.												
<i>Caesio tile</i>												
<i>Caesioninae</i> spp.												
Lutjanidae spp.												
Lethrinidae												
<i>Lethrinus</i> spp.												
<i>Lethrinidae</i> spp.												
Pomacentridae												
<i>Abudefduf coeruleostellus</i>												
Pomacentridae spp.												
Cirrhitidae												
<i>Cyprinocirrhites polyactis</i>								1				
<i>Cirrhitichthys</i> sp.												
Cirrhitidae spp.												
Champsodontidae												
<i>Champsodon</i> sp.												
Chiasmodontidae												
<i>Pseudoscopelus scriptus sagamianus</i>												
<i>Pseudoscopelus</i> sp.												
Ammodytidae												
<i>Embolichthys mitsukurii</i>												
Ammodytidae sp.?												
T O T A L		2	4	5	22	9	6	21	25	27	3	1

IK; IKPT Net, HE; Hexagon Net
Apogonidae, Carangidae, Chaetodontidae, Pomacanthidae, Labridae and Scaridae excluded.

Table 10-3. Continued

Species	No. of St. and net	29 IK	30 IK	32 IK	33 IK	34 IK	B IK-1	B IK-2	B IK-3	B IK-4	B IK-5	B HE-1
Percichthyidae												
<i>Synagrops japonicus</i>				4	2	1		2	2	1	2	5
<i>Malakichthys</i> sp.												
Serranidae												
<i>Cephalopholis</i> sp.								1		1	1	1
<i>Epinephelinae</i> spp.									1	1	1	1
<i>Lioploploma maculatum</i>						2		1	1		1	2
<i>Plectranthias</i> spp.										1	2	2
<i>Caprodon schlegelii</i>								1	1	3	4	2
<i>Odontanthias</i> sp.								1	3		5	6
<i>Holanthias</i> spp?						4			3	2		
<i>Tosanoides</i> sp.?								8	1	9	12	28
<i>Pseudanthias</i> spp.										3	1	
<i>Mirolabrichthys</i> spp.											1	
<i>Anthiinae</i> spp.											6	3
<i>Grammatonotus</i> sp.						3		1	7	1	1	3
<i>Symphtisanodontidae</i>								1	2	4	7	12
<i>Symphtisanodon</i> sp.									5	5	7	1
Grammistidae												
<i>Grammistes sexlineatus</i>												
Pseudogrammidæ												
<i>Pseudogramma polyacantha</i>								1	7	3	1	1
Priacanthidae												
<i>Pristigenys</i> sp.												
<i>Priacanthidae</i> spp.								3	4	2	2	5
Malacanthidae												
<i>Malacanthus brevirostris</i>												
<i>Hoplolatilus cuniculus</i> ?												
<i>H. fronticinctus</i>						1	1	2	3	1	3	4
Coryphaenidae												
<i>Coryphaena equiselis</i>						2						
<i>C. hippurus</i>												
<i>C. equiselis/C. hippurus</i>						1						1
Menidae												
<i>Mene maculata</i>												1
Leiognathidae									2			
<i>Leiognathus</i> sp.												
Bramidae												
<i>Brama japonica</i>												
<i>B. orcinii?</i>												1
<i>Taractes asper</i>												
<i>Ptervomclus petersii</i>												
Bramidae spp.												
Caristiidae												
<i>Caristius macropus</i>												
Emmelichthyidae												
<i>Erythrocles schlegelii</i>								1	2	2	4	1
<i>Erythrocles</i> sp.										3	1	5
Sciaenidae												
<i>Sciaenidae</i> sp.												1
Mullidae												
<i>Mullidae</i> sp.								1				
Lutjanidae												
<i>Etelis</i> sp.												
<i>Paracaeio</i> sp.												
<i>Etelinae</i> spp.								1	1	2	3	1
<i>Lutjanus</i> spp.									10	3	9	1
<i>Caesio tile</i>										1	3	1
<i>Caesioninae</i> spp.										1	1	2
<i>Lutjanidae</i> sp.												
Lethrinidae												
<i>Lethrinus</i> spp.									1		1	4
<i>Lethrinidae</i> spp.										1		
Pomacentridae												
<i>Abudefduf coeruleofasciatus</i>										6		5
<i>Pomacentridae</i> spp.												
Cirrhitidae												
<i>Cyprinocirrhites polyactis</i>												
<i>Cirrhitichthys</i> sp.												
<i>Cirrhitidae</i> spp.												
Champsodontidae												
<i>Champsodon</i> sp.												
Chiassomidae												
<i>Pseudoscopelus scriptus sagamianus</i>												
<i>Pseudoscopelus</i> sp.												
Ammodytidae												
<i>Embolichthys mitsukurii</i>											1	
<i>Ammodytidae</i> sp.?											2	
T O T A L		5	5	13	47	19	47	52	56	52	91	26

IK; IKPT Net, HE; Hexagon Net
Apogonidae, Carangidae, Chaetodontidae, Pomacanthidae, Labridae and Scaridae excluded.

Table 10-4. Continued

No. of St. and net	B HE-2	B HE-3	B HE-4	B HE-5	TOTAL
Percichthyidae					
<i>Synagrops japonicus</i>			1	3	31
<i>Malakichthys</i> sp.					1
Serranidae					
<i>Cephalopholis</i> sp.			4		6
<i>Epinephelinae</i> spp.					3
<i>Lioptopoma maculatum</i>					2
<i>Plectranthias</i> spp.	2		2	1	23
<i>Caprodon schlegelii</i>					1
<i>Odontanthias</i> sp.		2			18
<i>Holanthias</i> spp.	1	3		2	16
<i>Tosanoides</i> sp.?					1
<i>Pseudanthias</i> spp.	6	1	6	6	133
<i>Mirolabrichthys</i> spp.		1	1	2	8
<i>Anthiinae</i> spp.	1	1	2	3	51
<i>Grammatonotus</i> sp.				1	16
Sympsanoontidae					
<i>Sympsanodon</i> sp.	1		2	9	53
Grammistidae					
<i>Grammistes sexlineatus</i>					7
Pseudogrammidæ					
<i>Pseudogramma polycantha</i>	3	2	1		36
Priacanthidae					
<i>Pristigenys</i> sp.					1
<i>Priacanthidae</i> spp.	4	1		2	36
Malacanthidae					
<i>Malacanthus brevirostris</i>			1		2
<i>Hoplolatilus cuniculus?</i>	1	1		2	13
<i>H. fronticinctus</i>	1	5	2	4	37
Coryphaenidae					
<i>Coryphaena equiselis</i>					4
<i>C. hippurus</i>	1		1		8
<i>C. equiselis/C. hippurus</i>			1		3
Menidae					
<i>Mene maculata</i>		7	3	2	13
Leiognathidae					
<i>Leiognathus</i> sp.					2
Bramidae					
<i>Brama japonica</i>					2
<i>B. orcinii?</i>					3
<i>Taractes asper</i>	1	1			3
<i>Pterycombus petersii</i>	1	2	1	1	14
<i>Bramidae</i> spp.				1	22
Caristiidae					
<i>Caristius macropus</i>					1
Emmelichthyidae					
<i>Erythrocles schlegelii</i>	3	1	3	3	29
<i>Erythrocles</i> sp.				1	4
Sciaenidae					
<i>Sciaenidae</i> sp.					1
Mullidae					
<i>Mullidae</i> sp.					2
Lutjanidae					
<i>Etelis</i> sp.	2				2
<i>Paracaesio</i> sp.					2
<i>Etelinae</i> spp.	4	4	1	2	48
<i>Lutjanus</i> spp.	2	8	5	1	38
<i>Caesio</i> tile		1			5
<i>Caesioninae</i> spp.			1		14
<i>Lutjanidae</i> spp.					3
Lethrinidae					
<i>Lethrinus</i> spp.		1	1	1	9
<i>Lethrinidae</i> spp.	1				3
Poecacentridae					
<i>Abudefduf coeruleostellus</i>					1
<i>Pomacentridae</i> spp.		2	3	5	28
Cirrhitidae					
<i>Cyprinocirrhites polyactis</i>				1	4
<i>Cirrhitichthys</i> sp.			1		1
<i>Cirrhitidae</i> spp.		1			1
Champsodontidae					
<i>Champsodon</i> sp.					3
Chiassomidae					
<i>Pseudoscopelus scriptus sagamianus</i>					1
<i>Pseudoscopelus</i> sp.					6
Ammodytidae					
<i>Embolichthys mitsukurii</i>					2
<i>Ammodytidae</i> sp.?		1		1	4
T O T A L	35	47	48	54	781

IK: IKPT Net, HE: Hexagon Net
Apogonidae, Carangidae, Chaetodontidae, Pomacanthidae, Labridae and Scaridae excluded.

13. Studies on the distribution of eggs and larvae

Katsumi Matsushita

It is considered that the distributions of no motile eggs, larvae, and the other plankton are strongly influenced by various oceanographic conditions. Especially, ocean currents have important roles in the distribution and recruitment of pelagic fish concerning to the transportation mechanisms.

With these points in mind, a survey was carried out in order to know the general distribution of eggs, larvae, and settling volume during cruise and the relationships to the fluctuation of water temperature. The average temperature and standard deviation of 60 data measured every 1 minute with RMT (Rigou-sha Co. Ltd.) during cruise are shown in Fig. 19. Sometimes, the survey was stopped for reading the memorized data in RMT. At the same time, the eggs and larvae and the other plankton were filtered and collected from the Research Water of the R. V. Hakuho Maru with XX13 mesh nets alternatively. This sampling interval was 1 hour in principle. The settling volume during cruise are shown in Fig. 20. The analyses of these results will be carried in future.

In addition, MTD nets towings (6 sts., 8 layers, two times and supplemental 1 st.) were carried out at the cross section of the Kuroshio Current at the Bashi Channel. The vertical distributions of water properties, salinity and temperature, at the cross section are shown in Fig. 21. The distributions of eggs and larvae at the cross section are shown in Fig. 22. Classification of eggs and larvae have not been completed yet.

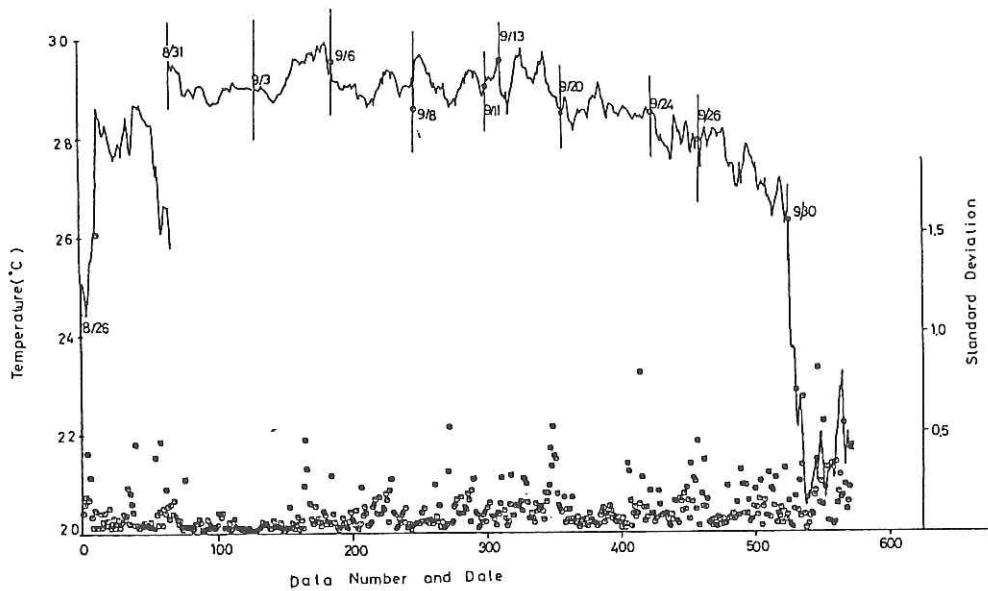


Fig. 19 The average temperature and standard deviations of 60 data measured every 1 minute with RMT (Rigou-sha Co. Ltd.) during cruise.

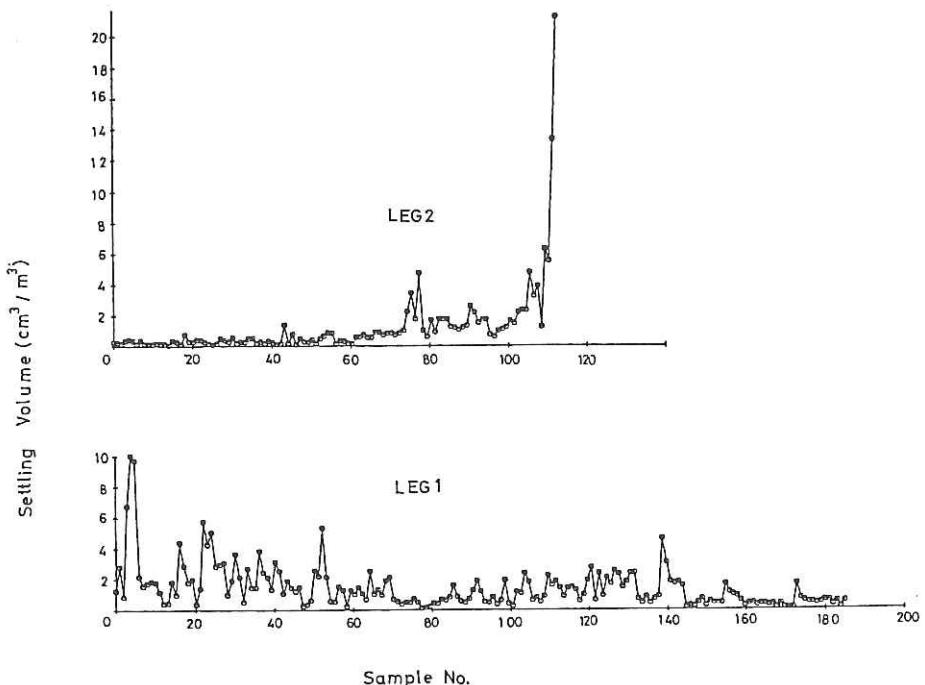


Fig. 20 The settling volume collected from Research Water of Hakuho-maru with XX13 mesh nets alternatively.

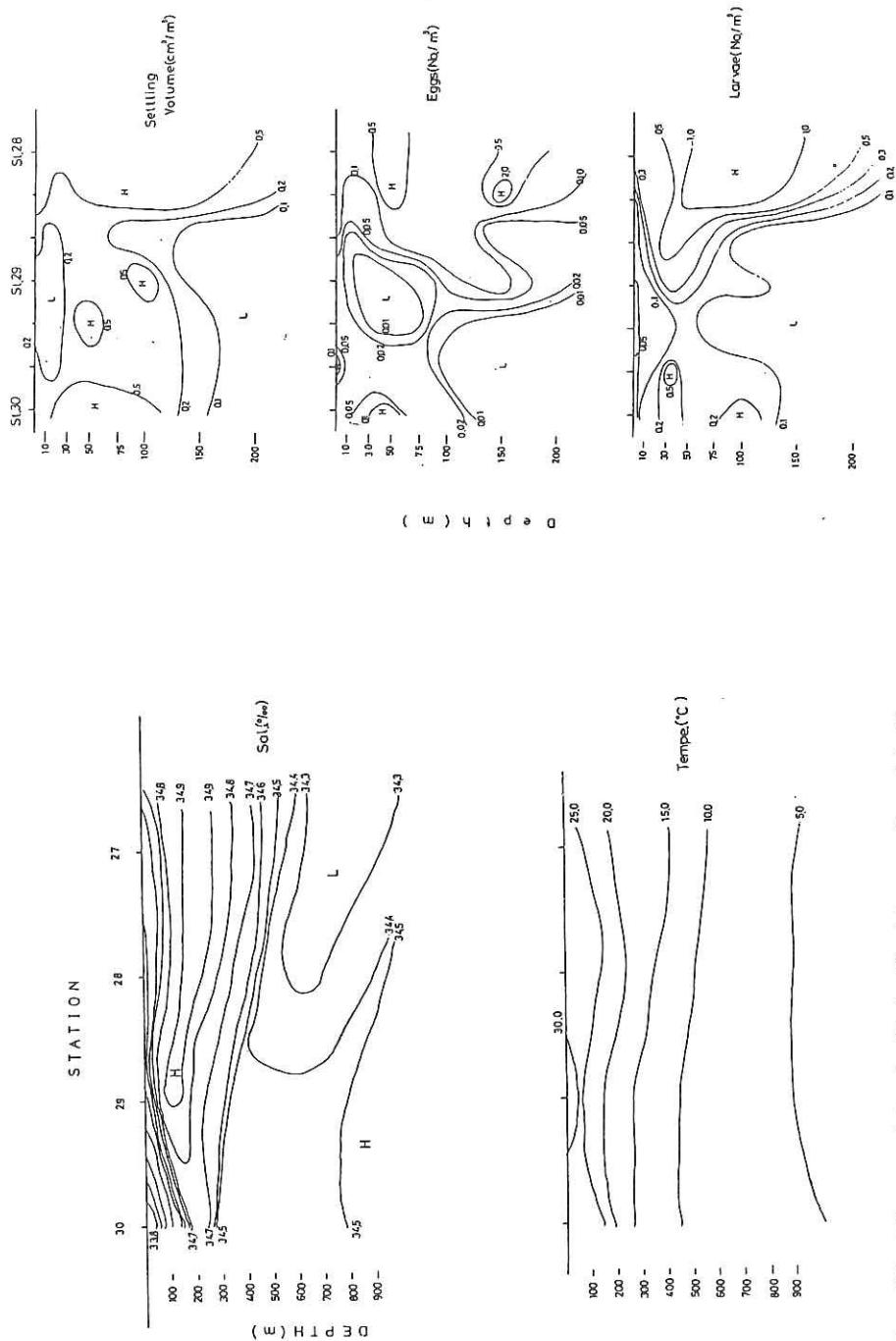


Fig. 21 The vertical distributions of salinity and temperature at the cross section of the Kuroshio Current at the Bashi Channel.

Fig. 22 The distribution of eggs and larvae at the cross section of the Kuroshio Current at the Bashi Channel.

14. Palinurid and scyllarid phyllosoma larvae

Hideo Sekiguchi

It is, first of all, my purpose to confirm whether phyllosoma larvae of Panulirus japonicus, commercially important in Japanese spiny lobster's fisheries and yielding annual catch of over a thousand of tons, occur in the western North Pacific, or not. However, no phyllosoma larva of P. japonicus was found in the larvae collected in this cruise, although those probably referable to P. penicillatus and P. versicolor were common. This fact is not always indicative that the P. japonicus larvae don't disperse and /or are not transported by the Kuroshio Countercurrent and the subtropical region in the western North Pacific. I had an impression that palinurid phyllosoma larvae would be sampled in the investigated area more commonly than in the Japanese coastal waters north of the Kuroshio Current.

In this cruise the phyllosoma larvae belonging to five genera (Panulirus, Palinurellus, Scyllarus, Scyllarides, Parribacus) were obtained (Table 11), of which those of two genera Panulirus and Scyllarus were predominant. Of Scyllarid phyllosoma larvae, those of Scyllarus bicuspidatus were common and abundant.

Four specimens of a unique phyllosoma (phylloamphion) were collected in the waters close to the Okinawa and Taiwan Islands, probably belonging to the genus Palinurellus of the Synaxisae.

Table 11. Phyllosoma larvae collected in the Hakuho Maru cruise KH-86-4.

	Sts. 1-34	St. A	St. B	St. C	Total
Palinuridae					
<u>Panulirus</u>	119	4	13	81	217
Synaxidae					
<u>Palinurellus</u>	2	0	1	1	4
Scyllaridae					
<u>Scyllarus</u>	112	0	60	50	222
<u>Scyllarides</u>	17	0	1	4	22
<u>Parribacus</u>	8	0	3	0	11
Total	258	4	78	136	476

15. Studies on dispersion of tropical grass shrimps by the Kuroshio Current

Hiroshi Mukai

Geographical distributions of tropical seagrasses and grass shrimps associated with them in Western Pacific can be predicted to be attributed to dispersions by drifting on warm currents, because the following facts were already clarified; (1) the center of distribution of tropical seagrasses was considered to be around Torres Strait in northern Australia and New Guinea Island, (2) geographical distributions of tropical seagrasses in Western Pacific are restricted almostly on the islands along the warm current, (3) the number of species of seagrasses on their islands is reversely related with distance from the center of distribution.

It is likely that wide-distributed grass shrimps. It is true in the genus Periclimenes of grass shrimps. However, the genus Latreutes has a contrary result. A hypothesis which can explain well these contradictory results is that two genera of grass shrimps have different modes of dispersion; that is, Periclimenes disperses in a larval stage, but Latreutes disperses in adult stage.

To examine this hypothesis, the net samples collected by IKMT-net and ORI-net in the Kuroshio Current for collection of leptocephalus larvae of Japanese eel, were checked. Several specimens of grass shrimps in larval stage (not identified yet) and drifting leaves of Thalassia hemprichii, a species of tropical seagrasses, were observed at sts. 33 and 34 close to Taiwan Island. But, most of samples was not completed to check, yet.

16. Lucifer, epiplanktonic shrimps,
collected during the KH-86-4

Tomohiko Kikuchi

In order to investigate taxonomical, morphological and biogeographical aspects of the epiplanktonic shrimps of the genus Lucifer, samplings was carried out using a 10-foot IKMT and ORI-69 net at more than 30 stations in the northwestern area of the western North Pacific during the research cruise of Hakuho Maru KH-86-4 in September, 1986.

Four species of this genus, i. e. Lucifer hansenii, L. intermedius, L. penicillifer and L. typus, were found in the survey area.

There is no way to distinguish between the females of these species, except by scanning electron microscopy. Further systematic studies are keenly needed for female specimens.

The relationships between the horizontal distribution and physical factors such as water temperature, salinity and surface current are now being analyzed.

17. Taxonomy and ecology of nano- and pico-phytoplankton

Nobuhito Hosaka

The purpose of this investigation is to clarify the community structure of phototrophs of nano- and pico-plankton size fractions ($0.2\text{-}20 \mu\text{m}$) in the oceanic water, and the daily variation in their ultrastructures.

Along the Kuroshio section in Leg 1 (3 stations) and during the buoy-tracking in Leg 2 (7 stations at 4 hours interval), seawater samples were collected from 10-m to 150-m depths with Van Dorn water samplers. Ten liter of seawater samples was filtered through a $20\text{-}\mu\text{m}$ mesh net to remove larger plankton and fixed by addition of 50 % biological grade glutaraldehyde to a final concentration of 0.1 % immediately after sampling. The suspension of cells was concentrated through Gelman GA6 filters (47 mm in diameter) by gentle suction. The concentrate on the filters was fixed again with 3 % glutaraldehyde buffered with 0.1 M cacodylate (pH=7.8). For electron microscopic observation, they were prepared as described by Johnson and Sieburth (1982). From the rest of the seawater samples, phytoplankton culture, which offered a good opportunity for reliable identification of species, was prepared according to the dilution method (Throndsen, 1969).

Reference

- Johnson, P. W. and J. McN. Sieburth (1982): In-situ morphology and occurrence of eucalyotic phototrophs of bacterial size in the picoplankton of estuarine and oceanic waters. *J. Phycol.*, 18: 318-327.
- Throndsen, J. (1969): Flagellates of Norwegian coastal waters. *Nytt Mag. Bot.*, 16 : 161-216.

18. Echo sounder measurement for small organisms and the echo in scattering layer

Tadashi Inagaki

In the fish stock measurement by echo sounder, it is important to obtain the information on the echo not only from fish school but also from other substances: plankton, micronekton, a layer with sharp gradient of sea water etc. SV value (value of scattering volume strength) for the echo from other substances has been observed frequently at the same level as the echo from fish school itself through the integral method.

In this cruise, the relationship between the echo from scattering layers of planktons and micronektons and the value of such small organisms collected by plankton net was investigated.

An echo sounder (Model FQ 50 & 200 KHz, Fruno electric Co., Ltd. Japan) and a plankton net (ORI 69 0.69 mm) were used. A total of 20 times horizontal hauls (towing time, 20 min) were made at 6 stations in daytime and nighttime at 50 m and 100 m layers from the surface. The measurements by the echo sounder were carried out during the period of net sampling simultaneously.

The values of small organisms estimated as settling volume were compared with the SV values in the two frequencies, 50 and 200 KHz respectively. The coefficient of correlation was 0.78 in both frequencies. The results are shown in Fig. 23 and 24.

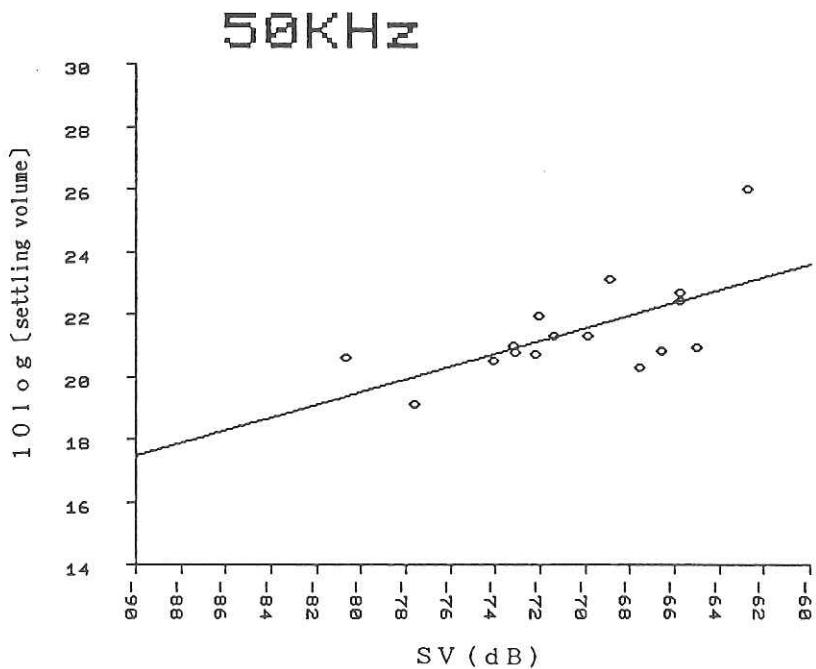


Fig. 23 Relationship between logarithm of settling volume (ml/l) and volume scattering strength (dB) for 50 KHz.

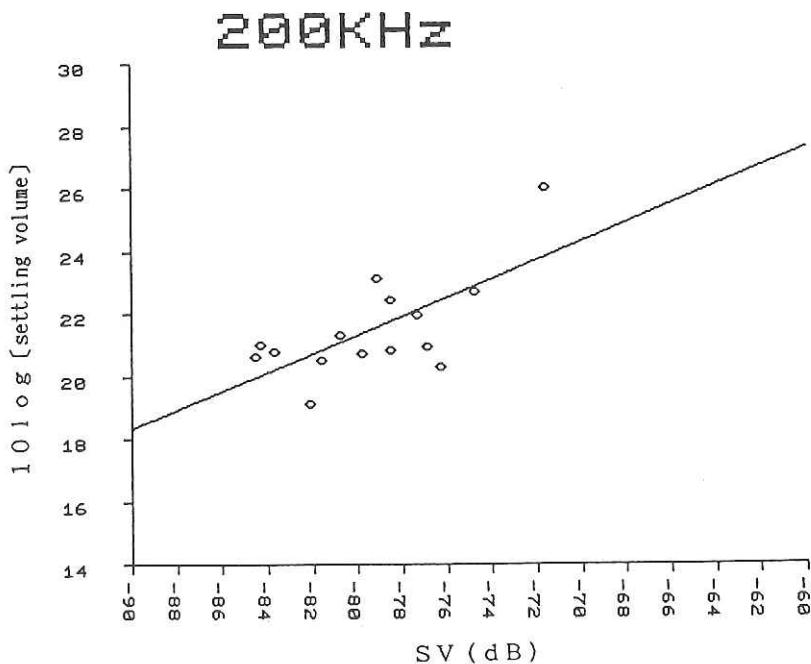


Fig. 24 Relationship between logarithm of settling volume (ml/l) and volume scattering strength (dB) for 200 KHz.

19. Measurements of the current of the upper layer with drifter in the vicinity of spawning ground of Anguilla japonica

Masato Kobayashi and Yasuhiro Kawasaki

To make clear the horizontal transport of the leptocephali (Anguilla japonica), the detail of current at the upper layer must be known in the vicinity of their spawning ground.

In the second Leg of this cruise, one radar tracked drifter was pursued during September 22 to 24. This apparatus was drogued by window shade screen at 2.5 m depth and attached the Digital Thermo Recorders (DTRs) at 6, 15 and 50 m depth. The schematic view of this is shown in Fig. 25. Fig. 26 shows the trajectory of the drifter and CTD and net towing stations. The drifter moved westward with the mean speed of about 27.3 cm/s. The wind velocity observed on the research vessel and the drifter velocity are shown in Fig. 27.

Fig. 28 shows the variation of the water temperature measured with DTRs at an interval of 5 minutes at 6, 15 and 50 m depth. Their water temperature variated hardly during the drifting period in this area.

These results should give us good ideas on the transport of leptocephali in the future.

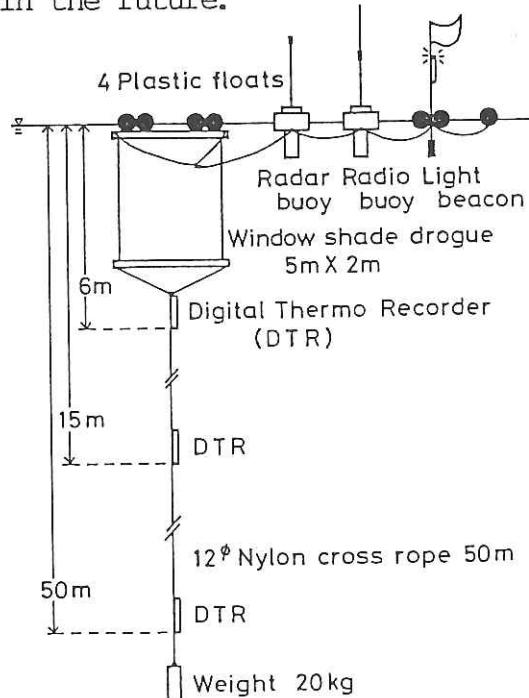


Fig. 25 Schematic view of the radar tracked drifter.

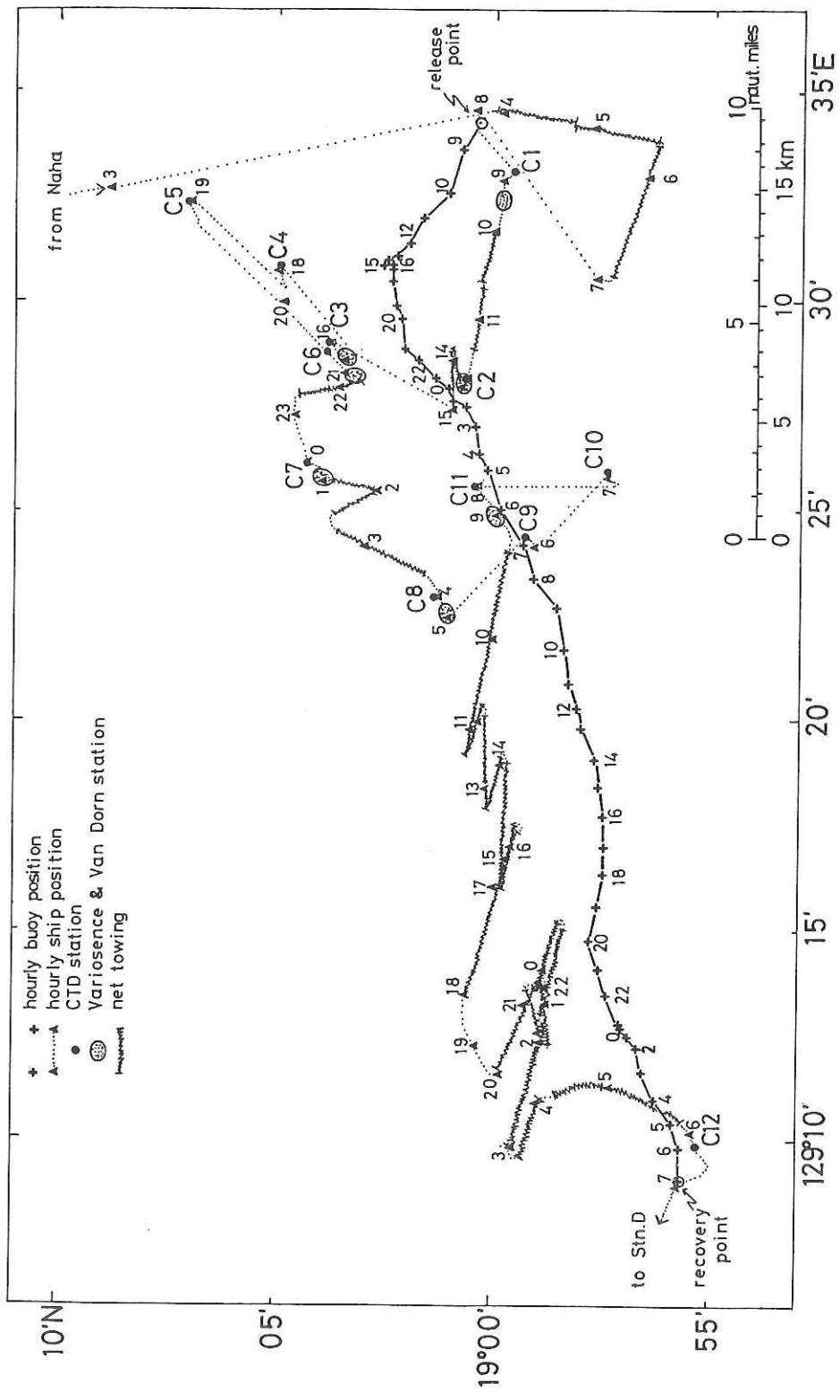


Fig. 26 Trajectory of the drifter and the net towing, and CTD station.

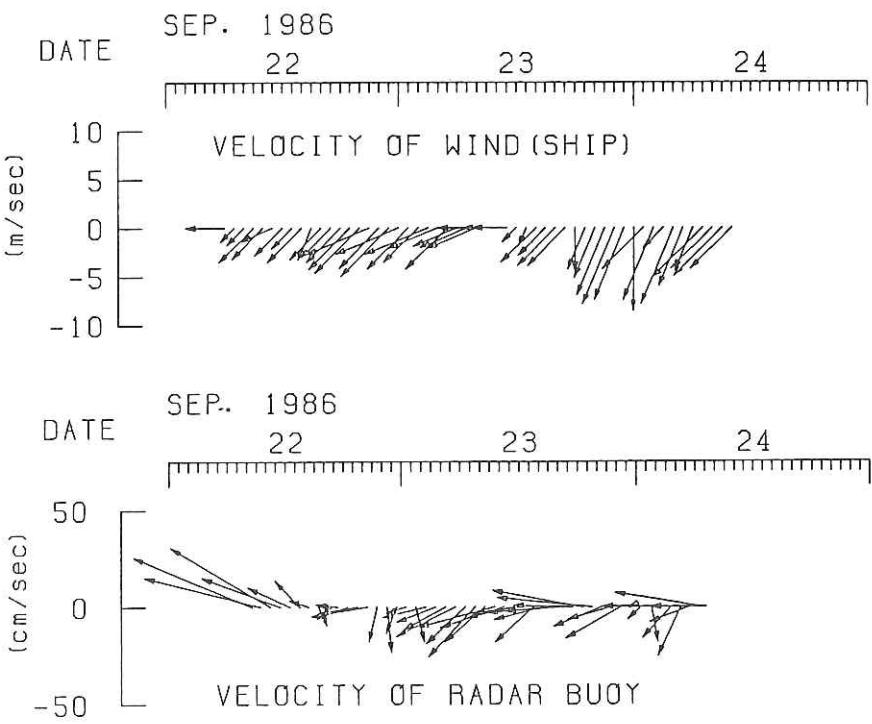


Fig. 27 Wind velocity observed on the research vessel and the drifter velocity.

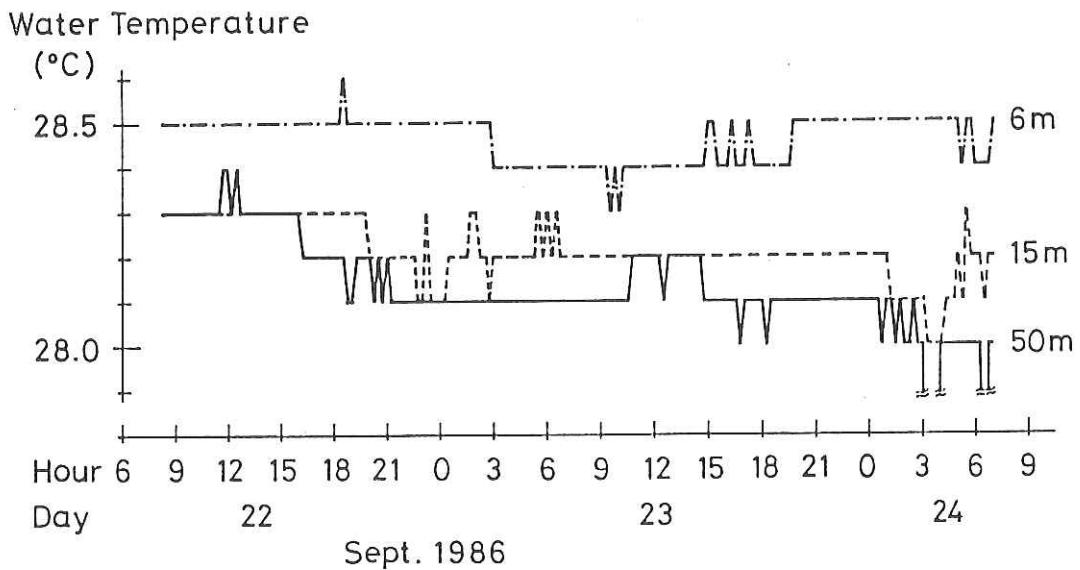


Fig. 28 Variation of the water temperature measured with DTRs at 6, 15 and 50 m depth.

IV. DATA FROM CTDO OBSERVATIONS

Station 1				4370m				Station 2				4300m				Station 3				4300m				Station 5570											
Date	Aug. 29 1986	Depth	Lat.	Date	Aug. 30 1986	Depth	Lat.	Date	Aug. 30 1986	Depth	Lat.	Date	Aug. 30 1986	Depth	Lat.	Date	Aug. 30 1986	Depth	Lat.	Date	Aug. 30 1986	Depth	Lat.	Date	Aug. 30 1986	Depth	Lat.								
TIME	23:30	Long.	25°00'.2 N	TIME	10:12	Long.	24°00'.0 N	TIME	10:42	Long.	129°35'.0 E	TIME	10:42	Long.	129°35'.1 E	TIME	10:42	Long.	129°42'.0 N	TIME	10:42	Long.	129°42'.0 E	TIME	10:42	Long.	129°42'.0 N								
D	T	S	0.0.	Dst	0.0.	Dst	0.0.	D	T	S	0.0.	Dst	0.0.	Dst	D	T	S	0.0.	Dst	0.0.	Dst	D	T	S	0.0.	Dst	0.0.	Dst							
m	C	mJ/t	cJ/t	m	C	mJ/t	cJ/t	m	C	mJ/t	cJ/t	m	C	mJ/t	cJ/t	m	C	mJ/t	cJ/t	m	C	mJ/t	cJ/t	m	C	mJ/t	cJ/t	m	C	mJ/t	cJ/t				
0	27.847	34.481	4.20	575.8	0.0000	0	28.170	34.632	----	575.0	0.0000	0	28.888	34.560	4.53	601.2	0.0000	0	28.888	34.560	4.53	601.2	0.0000	0	28.888	34.560	4.53	601.2	0.0000	0	28.888	34.560	4.53	601.2	0.0000
10	27.639	34.456	4.16	556.7	0.0569	10	28.182	34.628	----	575.7	0.0620	10	28.718	34.555	4.42	597.8	0.0607	10	28.718	34.555	4.42	597.8	0.0607	10	28.718	34.555	4.42	597.8	0.0607	10	28.718	34.555	4.42	597.8	0.0607
20	27.445	34.751	4.18	543.9	0.1125	20	28.042	34.652	----	569.5	0.1155	20	28.315	34.547	4.22	555.7	0.1203	20	28.315	34.547	4.22	555.7	0.1203	20	28.315	34.547	4.22	555.7	0.1203	20	28.315	34.547	4.22	555.7	0.1203
30	27.215	34.795	4.18	533.6	0.1682	30	27.995	34.658	----	567.6	0.1725	30	28.199	34.576	4.13	579.9	0.4800	30	28.199	34.576	4.13	579.9	0.4800	30	28.199	34.576	4.13	579.9	0.4800	30	28.199	34.576	4.13	579.9	0.4800
50	26.229	34.819	4.22	502.0	0.2711	50	27.555	34.648	----	554.7	0.2873	50	24.866	34.750	4.41	466.9	0.2830	50	24.866	34.750	4.41	466.9	0.2830	50	24.866	34.750	4.41	466.9	0.2830	50	24.866	34.750	4.41	466.9	0.2830
75	22.777	34.943	4.40	394.2	0.3836	75	23.336	34.852	----	416.2	0.4074	75	24.863	34.855	4.24	376.0	0.3900	75	24.863	34.855	4.24	376.0	0.3900	75	24.863	34.855	4.24	376.0	0.3900	75	24.863	34.855	4.24	376.0	0.3900
100	21.653	34.921	4.20	365.6	0.4805	100	21.174	34.881	----	356.0	0.5045	100	20.661	34.882	3.89	344.1	0.4814	100	20.661	34.882	3.89	344.1	0.4814	100	20.661	34.882	3.89	344.1	0.4814	100	20.661	34.882	3.89	344.1	0.4814
125	20.768	34.911	4.14	343.3	0.5687	125	20.268	34.877	----	333.0	0.5823	125	19.284	34.874	3.50	308.9	0.5629	125	19.284	34.874	3.50	308.9	0.5629	125	19.284	34.874	3.50	308.9	0.5629	125	19.284	34.874	3.50	308.9	0.5629
150	20.042	34.892	4.12	326.2	0.6533	150	19.718	34.876	----	319.3	0.6759	150	18.448	34.887	3.43	289.8	0.6400	150	18.448	34.887	3.43	289.8	0.6400	150	18.448	34.887	3.43	289.8	0.6400	150	18.448	34.887	3.43	289.8	0.6400
175	19.427	34.875	4.14	312.2	0.7353	175	19.095	34.872	----	304.2	0.7554	175	18.084	34.861	3.54	280.4	0.7121	175	18.084	34.861	3.54	280.4	0.7121	175	18.084	34.861	3.54	280.4	0.7121	175	18.084	34.861	3.54	280.4	0.7121
200	18.668	34.871	4.15	294.0	0.8139	200	18.430	34.871	----	208.3	0.80302	200	17.621	34.852	3.72	270.7	0.7825	200	17.621	34.852	3.72	270.7	0.7825	200	17.621	34.852	3.72	270.7	0.7825	200	17.621	34.852	3.72	270.7	0.7825
250	17.581	34.842	4.22	270.5	0.9587	250	17.750	34.867	----	272.6	0.9746	250	16.524	34.783	3.68	251.0	0.9166	250	16.524	34.783	3.68	251.0	0.9166	250	16.524	34.783	3.68	251.0	0.9166	250	16.524	34.783	3.68	251.0	0.9166
300	16.484	34.784	4.19	250.0	1.0916	300	16.807	34.800	----	256.1	1.1116	300	15.377	34.703	3.91	232.0	1.0408	300	15.377	34.703	3.91	232.0	1.0408	300	15.377	34.703	3.91	232.0	1.0408	300	15.377	34.703	3.91	232.0	1.0408
350	15.683	34.728	4.23	236.7	1.2190	350	15.900	34.745	----	240.1	1.2403	350	13.985	34.604	3.88	210.4	1.1610	350	13.985	34.604	3.88	210.4	1.1610	350	13.985	34.604	3.88	210.4	1.1610	350	13.985	34.604	3.88	210.4	1.1610
400	14.827	34.651	4.27	224.2	1.3398	400	14.738	34.652	----	222.3	1.3603	400	12.561	34.479	3.68	192.4	1.2667	400	12.561	34.479	3.68	192.4	1.2667	400	12.561	34.479	3.68	192.4	1.2667	400	12.561	34.479	3.68	192.4	1.2667
450	13.871	34.578	4.23	210.3	1.4529	450	13.671	34.561	----	207.6	1.4738	450	11.432	34.404	3.66	177.7	1.3647	450	11.432	34.404	3.66	177.7	1.3647	450	11.432	34.404	3.66	177.7	1.3647	450	11.432	34.404	3.66	177.7	1.3647
500	12.578	34.470	4.11	193.4	1.5602	500	11.763	34.420	----	182.2	1.5776	500	9.624	34.288	3.38	156.0	1.4535	500	9.624	34.288	3.38	156.0	1.4535	500	9.624	34.288	3.38	156.0	1.4535	500	9.624	34.288	3.38	156.0	1.4535
550	10.978	34.348	3.94	173.8	1.6563	550	10.464	34.330	----	166.5	1.6707	550	8.360	34.206	3.20	143.1	1.5335	550	8.360	34.206	3.20	143.1	1.5335	550	8.360	34.206	3.20	143.1	1.5335	550	8.360	34.206	3.20	143.1	1.5335
600	9.792	34.282	3.69	159.1	1.7474	600	8.667	34.216	----	146.8	1.7537	600	7.217	34.187	2.87	128.6	1.6065	600	7.217	34.187	2.87	128.6	1.6065	600	7.217	34.187	2.87	128.6	1.6065	600	7.217	34.187	2.87	128.6	1.6065
650	8.934	34.238	3.47	147.7	1.8303	650	7.482	34.176	----	133.0	1.8390	650	6.359	34.212	2.50	115.7	1.6724	650	6.359	34.212	2.50	115.7	1.6724	650	6.359	34.212	2.50	115.7	1.6724	650	6.359	34.212	2.50	115.7	1.6724
700	7.801	34.210	3.48	134.9	1.9075	700	6.524	34.168	----	121.1	1.8880	700	5.913	34.235	2.24	108.6	1.7333	700	5.913	34.235	2.24	108.6	1.7333	700	5.913	34.235	2.24	108.6	1.7333	700	5.913	34.235	2.24	108.6	1.7333
750	6.786	34.167	2.86	124.5	1.9771	750	5.903	34.188	----	112.1	1.9610	750	5.437	34.253	2.03	101.8	1.7906	750	5.437	34.253	2.03	101.8	1.7906	750	5.437	34.253	2.03	101.8	1.7906	750	5.437	34.253	2.03	101.8	1.7906
800	6.098	34.191	2.45	114.1	2.0419	800	5.443	34.219	----	104.4	2.0200	800	5.051	34.300	1.85	93.9	1.6443	800	5.051	34.300	1.85	93.9	1.6443	800	5.051	34.300	1.85	93.9	1.6443	800	5.051	34.300	1.85	93.9	1.6443
850	5.612	34.218	2.17	106.4	2.1029	850	5.089	34.263	----	97.1	2.0747	850	4.744	34.382	1.88	84.5	1.8937	850	4.744	34.382	1.88	84.5	1.8937	850	4.744	34.382	1.88	84.5	1.8937	850	4.744	34.382	1.88	84.5	1.8937
900	5.335	34.258	1.96	100.2	2.1596	900	4.676	34.308	----	89.3	2.1263	900	4.441	34.402	1.86	79.8	1.9395	900	4.441	34.402	1.86	79.8	1.9395	900	4.441	34.402	1.86	79.8	1.9395	900	4.441	34.402	1.86	79.8	1.9395
950	4.895	34.291	1.78	92.9	2.2130	950	4.215	34.363	----	80.4	2.1729	950	3.988	34.407	1.73	74.9	1.9826	950	3.988	34.407	1.73	74.9	1.9826	950	3.988	34.407	1.73	74.9	1.9826	950	3.988	34.407	1.73	74.9	1.9826
990	4.695	34.322	1.71	88.4	2.2566	990	4.037	34.398	----	76.0	2.2077	990	3.774	34.426	1.68	71.3	2.0236	990	3.774	34.426	1.68	71.3	2.0236	990	3.774	34.426	1.68	71.3	2.0236	990	3.774	34.426	1.68	71.3	2.0236

Station 6						Depth 5550m					
Date Aug. 31 1986			Lat. 21-00.1 N			Date Aug. 31 1986			Lat. 19-59.9 N		
TIME 03:04		Long. 129-35.1 E		TIME 10:45		Long. 129-35.1 E		TIME 16:11		Long. 129-34.6 E	
D	T	S	D.O.	Dst	Del-D	D	T	S	D.O.	Dst	Del-D
m	C		m/l	c/l/t		m	C		m/l	c/l/t	
0	29.334	34.337	4.14	633.2	0.0000	0	29.774	34.539	4.33	632.9	0.0000
10	29.310	34.452	3.91	624.1	0.0639	10	29.751	34.559	4.23	630.7	0.0652
20	29.229	34.499	3.85	618.2	0.1289	20	29.270	34.584	4.15	613.4	0.1266
30	29.133	34.525	3.83	613.2	0.1870	30	29.206	34.581	4.17	611.5	0.1892
50	29.059	34.551	3.87	609.0	0.3141	50	29.006	34.573	4.10	605.7	0.3140
75	27.401	34.596	4.01	553.7	0.4575	75	26.010	34.829	4.28	494.7	0.4509
100	25.347	34.813	3.98	476.3	0.5880	100	24.204	34.914	3.94	436.1	0.5675
125	23.464	34.893	3.73	416.8	0.6990	125	22.886	34.923	3.63	398.7	0.6714
150	22.076	34.947	3.57	377.2	0.7996	150	22.057	34.922	3.51	376.3	0.7704
175	20.731	34.879	3.46	344.7	0.8920	175	21.324	34.869	3.53	359.3	0.8627
200	19.797	34.884	3.43	320.7	0.9759	200	20.207	34.909	3.36	329.1	0.9516
250	17.880	34.850	3.39	276.9	1.1297	250	18.356	34.859	3.36	287.4	1.1087
300	16.948	34.802	3.42	259.0	1.2672	300	17.193	34.818	3.37	263.4	1.2515
350	15.512	34.694	3.42	235.5	1.3979	350	15.618	34.696	3.26	237.6	1.3808
400	14.057	34.584	3.31	213.7	1.5135	400	14.115	34.585	3.13	214.6	1.4999
450	12.584	34.485	3.18	191.3	1.6209	450	12.270	34.444	2.88	189.6	1.6063
500	10.789	34.347	3.10	170.7	1.7160	500	10.809	34.349	2.70	170.9	1.7023
550	9.402	34.251	2.95	155.4	1.8046	550	9.203	34.256	2.56	151.9	1.8774
600	8.215	34.209	2.70	140.7	1.0834	600	8.010	34.201	2.41	138.4	1.8661
650	7.317	34.220	2.37	127.5	1.9556	650	7.214	34.197	2.15	127.8	1.9372
700	6.420	34.261	2.04	112.8	2.0190	700	6.452	34.220	1.80	116.3	2.0029
750	5.507	34.230	1.80	104.3	2.0795	750	5.339	34.249	1.60	105.5	2.0636
800	5.576	34.373	1.79	94.4	2.1332	800	5.307	34.283	1.47	98.0	2.1189
850	4.658	34.316	1.48	88.2	2.1836	850	4.838	34.324	1.36	89.8	2.1702
900	4.225	34.355	1.34	81.1	2.2300	900	4.618	34.391	1.34	82.4	2.2176
950	4.013	34.398	1.31	76.6	2.2738	950	4.320	34.436	1.40	76.0	2.2618
990	3.856	34.406	1.32	73.6	2.3070	990	3.998	34.448	1.40	71.9	2.2954

Station 5						Depth 5700m					
Date Aug. 31 1986			Lat. 21-00.0 N			Date Aug. 31 1986			Lat. 19-59.9 N		
TIME 03:04		Long. 129-35.1 E		TIME 10:45		Long. 129-35.1 E		TIME 16:11		Long. 129-34.6 E	
D	T	S	D.O.	Dst	Del-D	D	T	S	D.O.	Dst	Del-D
m	C		m/l	c/l/t		m	C		m/l	c/l/t	
0	29.334	34.337	4.14	633.2	0.0000	0	29.774	34.539	4.33	632.9	0.0000
10	29.310	34.452	3.91	624.1	0.0639	10	29.751	34.559	4.23	630.7	0.0652
20	29.229	34.499	3.85	618.2	0.1289	20	29.270	34.584	4.15	613.4	0.1266
30	29.133	34.525	3.83	613.2	0.1870	30	29.206	34.581	4.17	611.5	0.1897
50	29.059	34.551	3.87	609.0	0.3141	50	29.006	34.573	4.10	605.7	0.3041
75	27.401	34.596	4.01	553.7	0.4575	75	26.010	34.829	4.28	494.7	0.4509
100	25.347	34.813	3.98	476.3	0.5880	100	24.204	34.914	3.94	436.1	0.5675
125	23.464	34.893	3.73	416.8	0.6990	125	22.886	34.923	3.63	398.7	0.6714
150	22.076	34.947	3.57	377.2	0.7996	150	22.057	34.922	3.51	376.3	0.7704
175	20.731	34.879	3.46	344.7	0.8920	175	21.324	34.869	3.53	359.3	0.8627
200	19.797	34.884	3.43	320.7	0.9759	200	20.207	34.909	3.36	329.1	0.9516
250	17.880	34.850	3.39	276.9	1.1297	250	18.356	34.859	3.36	287.4	1.1087
300	16.948	34.802	3.42	259.0	1.2672	300	17.193	34.818	3.37	263.4	1.2515
350	15.512	34.694	3.42	235.5	1.3979	350	15.618	34.696	3.26	237.6	1.3808
400	14.057	34.584	3.31	213.7	1.5135	400	14.115	34.585	3.13	214.6	1.4999
450	12.584	34.485	3.18	191.3	1.6209	450	12.270	34.444	2.88	189.6	1.6063
500	10.789	34.347	3.10	170.7	1.7160	500	10.809	34.349	2.70	170.9	1.7023
550	9.402	34.251	2.95	155.4	1.8046	550	9.203	34.256	2.56	151.9	1.8774
600	8.215	34.209	2.70	140.7	1.0834	600	8.010	34.201	2.41	138.4	1.8661
650	7.317	34.220	2.37	127.5	1.9556	650	7.214	34.197	2.15	127.8	1.9372
700	6.420	34.261	2.04	112.8	2.0190	700	6.452	34.220	1.80	116.3	2.0029
750	5.507	34.230	1.80	104.3	2.0795	750	5.339	34.249	1.60	105.5	2.0636
800	5.576	34.373	1.79	94.4	2.1332	800	5.307	34.283	1.47	98.0	2.1189
850	4.658	34.316	1.48	88.2	2.1836	850	4.838	34.324	1.36	89.8	2.1702
900	4.225	34.355	1.34	81.1	2.2300	900	4.618	34.391	1.34	82.4	2.2176
950	4.013	34.398	1.31	76.6	2.2738	950	4.320	34.436	1.40	76.0	2.2618
990	3.856	34.406	1.32	73.6	2.3070	990	3.998	34.448	1.40	71.9	2.2954

Station 9							Station 10								
5480m			6050m				5480m			6040m					
Date	Sep. 01 1986	Depth	Date	Sep. 01 1986	Depth	Date	Sep. 01 1986	Depth	Date	Sep. 01 1986	Depth	Date	Sep. 01 1986	Depth	
TIME	09:41	Lat.	TIME	09:41	Lat.	TIME	17:32	Lat.	TIME	17:32	Lat.	TIME	17:32	Lat.	
D	T	S	D	T	S	D	T	S	D	T	S	D	T	S	
m	C	m1/t	m	C	m1/t	m	C	m1/t	m	C	m1/t	m	C	m1/t	
0	29.228	34.739	4.16	600.9	0.0000	0	28.644	34.402	—	606.4	0.0000	0	28.876	34.533	3.97
10	29.194	34.748	4.22	599.1	0.0514	10	28.655	34.400	—	605.3	0.0639	10	28.896	34.548	3.88
20	29.079	34.713	4.14	598.0	0.1201	20	28.627	34.401	—	606.0	0.1241	20	28.877	34.567	3.90
30	28.960	34.685	4.15	596.4	0.1810	30	28.593	34.398	—	605.2	0.1849	30	28.973	34.627	3.95
50	27.387	34.734	4.25	543.3	0.2989	50	26.657	34.852	—	512.5	0.2955	50	27.669	34.626	3.87
75	24.809	34.977	4.16	440.8	0.4199	75	25.359	34.938	—	467.7	0.4187	75	25.406	34.848	3.78
100	23.567	35.042	3.95	400.9	0.5310	100	23.940	35.012	—	421.5	0.5321	100	24.658	35.050	3.82
125	22.697	35.033	3.76	395.6	0.6288	125	22.887	35.038	—	389.6	0.6354	125	23.289	35.006	3.51
150	21.524	35.009	3.53	355.8	0.7237	150	21.407	34.994	—	353.9	0.7294	150	21.399	34.974	3.41
175	20.482	34.979	3.44	331.1	0.8103	175	20.076	34.964	—	321.9	0.8137	175	20.238	34.935	3.50
200	19.936	34.925	3.33	296.6	0.8803	200	18.575	34.988	—	290.6	0.9034	200	19.316	34.926	3.46
250	16.962	34.793	3.27	260.0	1.0327	250	16.573	34.781	—	252.1	1.0315	250	17.390	34.824	3.53
300	15.121	34.652	3.24	230.3	1.1598	300	15.739	34.724	—	238.1	1.1585	300	16.002	34.747	3.55
350	13.450	34.524	3.16	206.0	1.2740	350	14.174	34.597	—	215.7	1.2771	350	14.257	34.586	3.38
400	11.984	34.415	3.00	186.6	1.3771	400	12.240	34.428	—	189.7	1.3824	400	12.348	34.433	3.26
450	10.381	34.301	2.93	167.3	1.4691	450	10.560	34.320	—	168.8	1.4770	450	10.312	34.330	2.79
500	9.187	34.267	2.69	150.8	1.5548	500	9.909	34.255	—	147.5	1.5607	500	8.973	34.267	2.49
550	8.253	34.270	2.13	136.8	1.6304	550	7.895	34.239	—	134.0	1.6356	550	7.717	34.247	2.14
600	7.277	34.276	1.88	122.0	1.7000	600	6.995	34.281	—	119.7	1.7033	600	6.593	34.248	1.77
650	6.601	34.259	1.71	112.3	1.7641	650	6.276	34.328	—	106.1	1.7639	650	5.984	34.288	1.57
700	5.990	34.298	1.61	104.8	1.0226	700	5.870	34.379	—	97.4	1.8198	700	5.645	34.352	1.48
750	5.466	34.358	1.55	96.0	1.8773	750	5.465	34.410	—	90.3	1.8704	750	5.254	34.385	1.47
800	5.066	34.350	1.55	87.6	1.9279	800	5.062	34.423	—	84.8	1.9194	800	4.993	34.440	1.59
850	4.677	34.429	1.56	80.2	1.9743	850	4.637	34.459	—	77.5	1.9638	850	4.617	34.447	1.54
900	4.414	34.459	1.56	75.2	2.0174	900	4.289	34.486	—	71.9	2.0056	900	4.287	34.482	1.61
950	4.157	34.482	1.60	70.9	2.0579	950	4.117	34.515	—	68.0	2.0450	950	4.027	34.507	1.69
990	3.980	34.496	1.63	68.1	2.0892	1000	3.938	34.498	—	67.5	2.0832	1000	3.881	34.536	1.47

Station 7	Depth	5480m	Station 8	Depth	6050m	Station 9	Depth	6040m	
Date	Sep. 01 1986	Lat.	Date	Sep. 01 1986	Lat.	Date	Sep. 01 1986	Lat.	
TIME	09:41	Long.	TIME	09:41	Long.	TIME	17:32	Long.	
D	T	S	D	T	S	D	T	S	
m	C	m1/t	m	C	m1/t	m	C	m1/t	
0	29.228	34.739	4.16	600.9	0.0000	0	28.644	34.402	—
10	29.194	34.748	4.22	599.1	0.0514	10	28.655	34.400	—
20	29.079	34.713	4.14	598.0	0.1201	20	28.627	34.401	—
30	28.960	34.685	4.15	596.4	0.1810	30	28.593	34.398	—
50	27.387	34.734	4.25	543.3	0.2989	50	26.657	34.852	—
75	24.809	34.977	4.16	440.8	0.4199	75	25.359	34.938	—
100	23.567	35.042	3.95	400.9	0.5310	100	23.940	35.012	—
125	22.697	35.033	3.76	395.6	0.6288	125	22.887	35.038	—
150	21.524	35.009	3.53	355.8	0.7237	150	21.407	34.994	—
175	20.482	34.979	3.44	331.1	0.8103	175	20.076	34.964	—
200	19.936	34.925	3.33	296.6	0.8803	200	18.575	34.988	—
250	16.962	34.793	3.27	260.0	1.0327	250	16.573	34.781	—
300	15.121	34.652	3.24	230.3	1.1598	300	15.739	34.724	—
350	13.450	34.524	3.16	206.0	1.2740	350	14.174	34.597	—
400	11.984	34.415	3.00	186.6	1.3771	400	12.240	34.428	—
450	10.381	34.301	2.93	167.3	1.4691	450	10.560	34.320	—
500	9.187	34.267	2.69	150.8	1.5548	500	9.909	34.255	—
550	8.253	34.270	2.13	136.8	1.6304	550	7.895	34.239	—
600	7.277	34.276	1.88	122.0	1.7000	600	6.995	34.281	—
650	6.601	34.259	1.71	112.3	1.7641	650	6.276	34.328	—
700	5.990	34.298	1.61	104.8	1.0226	700	5.870	34.379	—
750	5.466	34.358	1.55	96.0	1.8773	750	5.465	34.410	—
800	5.066	34.350	1.55	87.6	1.9279	800	5.062	34.423	—
850	4.677	34.429	1.56	80.2	1.9743	850	4.637	34.459	—
900	4.414	34.459	1.56	75.2	2.0174	900	4.289	34.486	—
950	4.157	34.482	1.60	70.9	2.0579	950	4.117	34.515	—
990	3.980	34.496	1.63	68.1	2.0892	1000	3.938	34.498	—

Station A									Depth 5200m												
Station			11			5670m			Station			A			Depth			5200m			
Date	Sep. 02 1986	Depth	5500m	Date	Sep. 02 1986	Lat.	15°00'.2 N	TIME	Sep. 02 1986	Lat.	15°00'.2 N	TIME	Sep. 03 1986	Lat.	14°05'.1 N	TIME	Sep. 03 1986	Lat.	14°17'.4 E		
TIME	09:44	Long.	129°35'.2 E	TIME	09:44	Long.	129°35'.2 E	D	T	S	D.O.	Dst	De1-D	D	T	S	D.O.	Dst	De1-D		
m	C	mJ/1	cJ/t	m	C	mJ/1	cJ/t	m	C	mJ/1	cJ/t	m	C	m	C	mJ/1	cJ/t	m	C		
0	28.517	34.568	4.43	589.0	0.0000	0	28.684	34.357	4.30	609.4	0.0000	0	28.834	34.218	4.26	625.7	0.0000	0	28.834	34.218	4.26
10	28.524	34.568	4.09	589.3	0.0592	10	28.641	34.356	4.09	609.5	0.0628	10	28.836	34.257	4.13	623.0	0.0653	10	28.836	34.257	4.13
20	28.526	34.568	4.16	589.3	0.1190	20	28.613	34.370	4.06	607.8	0.1228	20	28.840	34.278	4.15	621.6	0.1275	20	28.840	34.278	4.15
30	28.514	34.565	4.11	588.2	0.1618	30	28.604	34.403	4.03	605.1	0.1840	30	28.841	34.283	4.09	621.2	0.1895	30	28.841	34.283	4.09
50	28.385	34.602	4.08	588.9	0.2980	50	28.521	34.407	4.04	602.2	0.3052	50	28.815	34.318	4.06	617.9	0.3139	50	28.815	34.318	4.06
75	27.155	34.861	4.09	527.0	0.4380	75	26.702	34.693	4.06	525.3	0.4480	75	28.694	34.306	4.04	615.0	0.4686	75	28.694	34.306	4.04
100	25.778	34.967	3.95	478.0	0.5620	100	25.044	35.010	4.07	453.3	0.5706	100	28.282	34.456	4.04	591.1	0.6200	100	28.282	34.456	4.04
125	23.977	35.023	3.60	421.8	0.6776	125	23.204	34.993	3.92	402.3	0.6782	125	26.963	34.839	4.00	523.4	0.7598	125	26.963	34.839	4.00
150	21.232	34.975	3.32	350.7	0.7753	150	21.430	34.957	3.47	357.2	0.7750	150	24.632	34.934	3.67	446.8	0.8631	150	24.632	34.934	3.67
175	19.766	34.887	3.71	319.0	0.8592	175	19.852	34.925	3.09	319.1	0.8600	175	22.212	34.938	3.20	379.3	0.9900	175	22.212	34.938	3.20
200	18.704	34.872	3.61	294.8	0.9392	200	18.294	34.850	3.19	286.6	0.9377	200	20.027	34.959	3.14	321.0	1.0760	200	20.027	34.959	3.14
250	16.573	34.784	3.53	252.0	1.0788	250	15.495	34.643	2.76	238.2	1.0734	250	14.975	34.613	3.04	230.1	1.2193	250	14.975	34.613	3.04
300	15.194	34.677	3.50	230.0	1.2032	300	12.504	34.458	2.86	192.9	1.1844	300	12.283	34.447	2.92	189.6	1.3281	300	12.283	34.447	2.92
350	13.306	34.523	3.35	204.4	1.3164	350	10.701	34.349	2.64	169.0	1.2769	350	9.768	34.309	2.37	156.8	1.4168	350	9.768	34.309	2.37
400	11.167	34.371	2.87	175.4	1.4150	400	8.873	34.283	2.20	144.9	1.3605	400	8.816	34.454	1.45	131.4	1.4929	400	8.816	34.454	1.45
450	9.472	34.304	2.43	152.5	1.5045	450	7.654	34.272	1.90	128.2	1.4324	450	7.851	34.489	1.35	114.9	1.5584	450	7.851	34.489	1.35
500	8.010	34.315	1.88	130.0	1.5769	500	7.036	34.334	1.61	145.3	1.4968	500	7.384	34.504	1.45	107.2	1.6176	500	7.384	34.504	1.45
550	7.365	34.356	1.63	118.0	1.6427	550	6.506	34.373	1.51	105.5	1.5560	550	6.862	34.512	1.57	99.7	1.6732	550	6.862	34.512	1.57
600	6.726	34.404	1.51	106.1	1.7035	600	6.139	34.405	1.48	98.6	1.6115	600	6.235	34.465	1.63	95.3	1.7265	600	6.235	34.465	1.63
650	6.220	34.417	1.54	98.7	1.7593	650	6.024	34.463	1.60	92.9	1.6629	650	6.120	34.489	1.68	92.1	1.7773	650	6.120	34.489	1.68
700	5.000	34.443	1.55	91.7	1.8100	700	5.640	34.488	1.69	86.4	1.7124	700	5.994	34.521	1.82	88.2	1.8274	700	5.994	34.521	1.82
750	5.463	34.495	1.57	86.2	1.8899	750	5.321	34.506	1.88	81.4	1.7590	750	5.788	34.552	2.00	83.4	1.8744	750	5.788	34.552	2.00
800	5.290	34.494	1.69	82.0	1.9065	800	5.091	34.526	1.96	77.3	1.8632	800	5.641	34.563	2.10	80.9	1.9202	800	5.641	34.563	2.10
850	4.973	34.514	1.76	77.0	1.9509	850	4.864	34.533	1.96	74.3	1.8452	850	5.138	34.526	1.97	77.9	1.9648	850	5.138	34.526	1.97
900	4.644	34.530	1.86	72.3	1.9926	900	4.616	34.542	1.98	71.1	1.8864	900	4.867	34.540	2.00	73.9	2.0083	900	4.867	34.540	2.00
950	4.431	34.545	1.97	68.9	2.0331	950	4.370	34.551	2.08	67.8	1.9257	950	4.693	34.563	2.05	70.3	2.0489	950	4.693	34.563	2.05
1000	3.881	34.556	1.47	64.1	2.0671	1000	3.881	34.556	1.47	64.1	1.9595	1000	3.938	34.498	1.64	60.0	1.3470	1000	3.938	34.498	1.64

Station	12	Depth	5450m	Station	13	Depth	3770m										
Date	Sep. 03 1986	Lat.	15°00'.4 N	Date	Sep. 03 1986	Lat.	15°59'.8 N										
TIME	11:50	Long.	121°40'.1 E	TIME	20:30	Long.	121°40'.1 E										
D	T	S	O.D.	D	T	S	O.D.										
m	C	m1/1	c1/t	m	C	m1/1	c1/t										
0	28.780	34.394	4.12	611.6	0.0000	0	28.786	34.363	4.38	613.8	0.0000	0	28.689	34.441	4.05	604.4	0.0000
10	28.780	34.392	4.14	611.5	0.0624	10	28.790	34.362	4.24	614.0	0.0631	10	28.688	34.442	4.09	604.4	0.0614
20	28.773	34.392	4.13	611.3	0.1236	20	28.789	34.363	4.04	613.7	0.1274	20	28.688	34.441	4.11	604.4	0.1227
30	28.762	34.389	4.05	611.1	0.1664	30	28.787	34.362	4.08	613.9	0.1647	30	28.673	34.442	4.04	604.5	0.1635
50	28.757	34.390	3.96	610.9	0.3086	50	28.756	34.455	4.09	599.5	0.3094	50	27.739	34.484	4.43	572.2	0.3020
75	28.111	34.483	3.96	583.8	0.4605	75	26.870	34.665	4.17	532.4	0.4489	75	25.784	34.755	4.17	493.4	0.4350
100	26.671	34.858	3.91	512.5	0.5980	100	25.604	34.928	3.96	475.6	0.5761	100	23.984	35.011	3.91	422.8	0.5497
125	25.259	34.942	3.71	464.5	0.7166	125	23.739	34.950	3.71	420.4	0.6901	125	22.453	34.964	3.59	383.9	0.6519
150	23.145	34.972	3.36	402.3	0.8302	150	22.143	34.986	3.46	373.1	0.7904	150	21.350	34.982	3.54	354.7	0.7454
175	21.837	34.926	2.94	370.2	0.9274	175	20.714	34.953	3.39	338.9	0.8802	175	19.178	34.909	3.41	303.6	0.8295
200	20.326	34.882	2.78	334.4	1.0190	200	19.545	34.878	3.64	314.9	0.9635	200	18.080	34.856	3.49	284.2	0.9063
250	16.375	34.722	2.89	252.1	1.1673	250	18.122	34.860	3.60	281.8	1.1155	250	16.558	34.788	3.67	251.4	1.0416
350	11.982	34.424	2.69	186.1	1.3943	350	13.038	34.468	2.82	200.7	1.3654	350	13.753	34.560	3.54	209.2	1.2799
400	10.313	34.346	2.50	162.9	1.4858	400	10.708	34.344	2.94	169.6	1.4638	400	11.943	34.427	3.34	184.9	1.3834
450	9.002	34.327	2.09	143.5	1.5676	450	9.049	34.280	2.51	147.8	1.5464	450	10.254	34.313	3.14	164.3	1.4750
500	7.341	34.301	1.81	121.8	1.6378	500	7.945	34.284	2.11	131.3	1.6204	500	8.559	34.241	2.65	143.0	1.5575
550	6.793	34.368	1.59	103.6	1.6997	550	7.105	34.297	1.93	118.9	1.6676	550	7.615	34.318	2.02	124.2	1.6278
600	6.203	34.381	1.57	101.3	1.7558	600	6.595	34.375	1.75	106.5	1.7477	600	6.858	34.346	1.85	112.0	1.6914
650	5.829	34.427	1.65	93.3	1.8066	650	6.133	34.422	1.73	97.3	1.8033	650	6.445	34.380	1.93	104.3	1.7500
700	5.410	34.472	1.77	85.0	1.8573	700	5.652	34.461	1.82	88.6	1.8543	700	6.171	34.423	1.83	97.7	1.8049
750	5.116	34.502	1.85	79.5	1.9032	750	5.253	34.469	1.90	81.9	1.9013	750	5.579	34.424	1.85	90.5	1.8570
800	4.827	34.520	1.93	74.9	1.9455	800	4.976	34.509	1.95	77.4	1.9450	800	5.339	34.463	1.89	84.9	1.9056
850	4.652	34.536	1.92	71.9	1.9006	850	4.728	34.526	2.06	73.5	1.9874	850	4.893	34.466	1.96	79.7	1.9514
900	4.442	34.552	2.06	68.5	2.0282	900	4.435	34.542	2.09	69.2	2.0278	900	4.682	34.493	2.02	75.4	1.9850
950	4.256	34.563	2.12	65.8	2.0640	950	4.232	34.548	2.11	66.6	2.0564	950	4.327	34.507	2.13	70.7	2.0355
995	4.097	34.572	2.17	63.5	2.0974	995	4.061	34.558	2.14	64.2	2.0993	995	4.204	34.547	2.21	66.5	2.0744

Station	14	Depth	5050m	Station	14	Depth	5050m
Date	Sep. 04 1986	Lat.	17°03'.4 N	Date	Sep. 04 1986	Lat.	17°12'.3 E
TIME	07:37	Long.	121°40'.1 E	TIME	07:37	Long.	121°40'.1 E
D	T	S	O.D.	D	T	S	O.D.
m	C	m1/1	c1/t	m	C	m1/1	c1/t

Station 17						Depth 5440m					
Date Sep. 04 1986			Date Sep. 05 1986			Lat. 18°59'.9 N			Lat. 20°03'.7 N		
TIME 13:02		TIME 20:33		TIME 07:10		Long. 127°09'.8 E		Long. 127°40.0 E		TIME 07:10	
D	T	S	D.O.	Dst	De1-D	D	T	S	D.O.	Dst	De1-D
m	C	ml/1	c1/t	ml/1	c1/t	m	C	ml/1	c1/t	ml/1	c1/t
0	29.050	34.634	4.38	602.7	0.0000	0	29.365	34.625	4.17	613.5	0.0000
10	28.998	34.636	4.06	600.9	0.0623	10	29.366	34.631	4.17	613.0	0.0664
20	28.859	34.549	3.98	595.6	0.1203	20	29.185	34.609	4.16	608.8	0.1272
30	28.850	34.652	3.98	595.0	0.1804	30	29.173	34.622	4.14	607.5	0.1883
50	26.741	34.782	4.13	521.5	0.2954	50	29.155	34.646	4.14	605.2	0.3065
75	25.202	34.973	4.12	460.5	0.4194	75	27.065	34.875	4.37	523.3	0.4518
100	24.125	35.054	3.86	423.8	0.5307	100	25.915	34.920	4.16	495.4	0.5776
125	22.820	35.020	3.65	390.1	0.6334	125	24.582	34.978	3.94	442.6	0.6922
150	21.804	34.987	3.46	364.9	0.7271	150	23.520	35.031	3.77	408.4	0.8022
175	20.583	34.946	3.48	336.0	0.8163	175	22.359	34.977	3.67	380.4	0.9019
200	19.375	34.929	3.42	307.0	0.8985	200	20.928	34.924	3.72	346.7	0.9850
250	17.499	34.830	3.48	269.5	1.0457	250	18.825	34.877	3.66	297.3	1.1598
350	14.091	34.577	3.47	214.7	1.2981	350	16.020	34.751	3.72	242.2	1.4373
400	12.306	34.453	3.27	191.1	1.4038	400	14.180	34.584	3.56	216.0	1.5580
450	10.657	34.332	2.90	169.6	1.4906	450	12.525	34.449	3.28	193.9	1.6656
500	9.380	34.270	2.73	153.6	1.5844	500	14.009	34.360	3.03	173.4	1.7625
550	7.927	34.235	2.34	134.7	1.6609	550	9.527	34.300	2.71	153.6	1.8500
600	7.041	34.248	2.02	121.8	1.7288	600	8.412	34.283	2.45	138.1	1.9291
650	6.348	34.260	1.75	111.4	1.7927	650	6.980	34.232	2.15	122.1	1.9883
700	5.612	34.296	1.59	101.6	1.8502	700	6.170	34.243	1.93	111.1	2.0623
750	5.250	34.328	1.51	94.0	1.9030	750	5.577	34.256	1.81	103.2	2.1203
800	4.897	34.382	1.51	86.1	1.9519	800	5.083	34.326	1.70	92.3	2.1732
850	4.585	34.434	1.55	78.9	1.9876	850	4.848	34.354	1.72	87.7	2.2231
900	4.377	34.468	1.65	74.1	2.0405	900	4.547	34.406	1.70	80.6	2.2693
950	4.139	34.498	1.77	69.5	2.0604	950	4.305	34.449	1.78	74.8	2.3129
995	3.975	34.524	1.88	65.9	2.1149	1000	4.102	34.475	1.95	70.9	2.3534

Station 16						Depth 5300m					
Date Sep. 04 1986			Date Sep. 04 1986			Lat. 18°59'.9 N			Lat. 18°59'.9 N		
TIME 13:02		TIME 20:33		TIME 07:10		Long. 127°09'.8 E		Long. 127°09'.8 E		TIME 07:10	
D	T	S	D.O.	Dst	De1-D	D	T	S	D.O.	Dst	De1-D
m	C	ml/1	c1/t	ml/1	c1/t	m	C	ml/1	c1/t	ml/1	c1/t
0	29.050	34.634	4.38	602.7	0.0000	0	29.365	34.625	4.17	613.5	0.0000
10	28.998	34.636	4.06	600.9	0.0623	10	29.366	34.631	4.17	613.0	0.0664
20	28.859	34.549	3.98	595.6	0.1203	20	29.185	34.609	4.16	608.8	0.1272
30	28.850	34.652	3.98	595.0	0.1804	30	29.173	34.622	4.14	607.5	0.1883
50	26.741	34.782	4.13	521.5	0.2954	50	29.155	34.646	4.14	605.2	0.3065
75	25.202	34.973	4.12	460.5	0.4194	75	27.065	34.875	4.37	523.3	0.4518
100	24.125	35.054	3.86	423.8	0.5307	100	25.915	34.920	4.16	495.4	0.5776
125	22.820	35.020	3.65	390.1	0.6334	125	24.582	34.978	3.94	442.6	0.6922
150	21.804	34.987	3.46	364.9	0.7271	150	23.520	35.031	3.77	408.4	0.8022
175	20.583	34.946	3.48	336.0	0.8163	175	22.359	34.977	3.67	380.4	0.9019
200	19.375	34.929	3.42	307.0	0.8985	200	20.928	34.924	3.72	346.7	0.9850
250	17.499	34.830	3.48	269.5	1.0457	250	18.825	34.877	3.66	297.3	1.1598
350	14.091	34.577	3.47	214.7	1.2981	350	16.020	34.751	3.72	242.2	1.4373
400	12.306	34.453	3.27	191.1	1.4038	400	14.180	34.584	3.56	216.0	1.5580
450	10.657	34.332	2.90	169.6	1.4906	450	12.525	34.449	3.28	193.9	1.6656
500	9.380	34.270	2.73	153.6	1.5844	500	14.009	34.360	3.03	173.4	1.7625
550	7.927	34.235	2.34	134.7	1.6609	550	9.527	34.300	2.71	153.6	1.8500
600	7.041	34.248	2.02	121.8	1.7288	600	8.412	34.283	2.45	138.1	1.9291
650	6.348	34.260	1.75	111.4	1.7927	650	6.980	34.232	2.15	122.1	1.9883
700	5.612	34.296	1.59	101.6	1.8502	700	6.170	34.243	1.93	111.1	2.0623
750	5.250	34.328	1.51	94.0	1.9030	750	5.577	34.256	1.81	103.2	2.1203
800	4.897	34.382	1.51	86.1	1.9519	800	5.083	34.326	1.70	92.3	2.1732
850	4.585	34.434	1.55	78.9	1.9876	850	4.848	34.354	1.72	87.7	2.2231
900	4.377	34.468	1.65	74.1	2.0405	900	4.547	34.406	1.70	80.6	2.2693
950	4.139	34.498	1.77	69.5	2.0604	950	4.305	34.449	1.78	74.8	2.3129
995	3.975	34.524	1.88	65.9	2.1149	1000	4.102	34.475	1.95	70.9	2.3534

5570m								5670m									
Station 10				Depth 5500m				Station 19				Depth 5400m					
Date	Sep. 05 1986	Depth	Lat.	Date	Sep. 05 1986	Depth	Lat.	Date	Sep. 06 1986	Depth	Lat.	Date	Sep. 06 1986	Depth	Lat.		
TIME	12:38	Long.	21-00.0 N	TIME	21:05	Long.	21-59.8 N	TIME	08:45	Long.	23-04.9 N	TIME	09:07	Long.	127-00.0 E		
D	T	S	D.O.	D	T	S	D.O.	D	T	S	D.O.	D	T	S	D.O.		
m	C	m/l	c/l/t	m	C	m/l	c/l/t	m	C	m/l	c/l/t	m	C	m/l	c/l/t		
0	29.544	34.524	4.17	626.5	0.0000	0	29.078	34.531	3.83	614.0	0.0000	0	28.844	34.386	4.42	613.0	0.0000
10	29.463	34.521	3.93	624.1	0.0634	10	29.089	34.531	3.69	614.4	0.0615	10	28.798	34.445	4.21	608.3	0.0655
20	29.355	34.518	3.92	620.8	0.1264	20	29.071	34.530	3.69	610.8	0.1239	20	28.792	34.481	4.19	605.5	0.1236
30	29.315	34.524	3.78	619.1	0.1892	30	28.759	34.523	3.69	601.4	0.1689	30	28.791	34.500	4.07	604.0	0.1844
50	28.902	34.592	3.79	603.5	0.3117	50	28.417	34.550	3.69	588.7	0.3034	50	28.333	34.507	4.02	569.1	0.3043
75	25.007	34.817	3.85	466.2	0.4445	75	27.334	34.587	3.70	551.6	0.4480	75	27.116	34.525	4.03	542.9	0.4453
100	23.292	34.920	3.75	410.0	0.5548	100	25.410	34.807	3.74	478.6	0.5758	100	24.132	34.924	3.85	440.6	0.5708
125	21.083	34.914	3.62	372.2	0.6553	125	23.516	34.893	3.54	410.2	0.6805	125	22.860	34.863	3.61	400.0	0.6751
150	21.161	34.913	3.54	353.3	0.7459	150	21.562	34.913	3.28	363.8	0.7907	150	21.514	34.864	3.53	364.7	0.7718
175	20.385	34.892	3.47	334.9	0.6351	175	20.762	34.915	3.22	342.9	0.8798	175	20.347	34.863	3.59	356.0	0.8609
200	19.002	34.909	3.38	319.0	0.9170	200	19.667	34.895	3.16	316.7	0.9624	200	19.145	34.871	3.62	305.6	0.9433
250	18.108	34.855	3.30	283.7	1.0712	250	18.161	34.856	3.28	283.1	1.1173	250	17.501	34.831	3.67	268.5	1.0805
350	15.438	34.701	3.47	233.3	1.3404	350	16.048	34.744	3.46	243.3	1.3800	350	15.433	34.675	3.51	235.2	1.3524
400	14.023	34.576	3.39	213.4	1.4576	400	14.552	34.623	3.50	220.7	1.5106	400	14.217	34.588	3.56	216.4	1.4700
450	12.542	34.454	3.27	193.9	1.5640	450	13.257	34.509	3.46	203.3	1.6227	450	12.702	34.496	3.29	193.8	1.5797
500	10.010	34.334	3.40	172.3	1.6644	500	11.371	34.368	3.37	173.1	1.7247	500	11.013	34.414	3.02	169.5	1.6752
550	9.411	34.260	2.87	154.8	1.7476	550	10.025	34.283	3.17	162.8	1.8348	550	9.472	34.302	2.90	152.7	1.7617
600	7.992	34.226	2.56	136.3	1.8926	600	8.746	34.219	2.87	147.8	1.8980	600	8.489	34.256	2.72	141.2	1.8405
650	7.275	34.203	2.49	128.2	1.8976	650	7.536	34.188	2.61	132.8	1.9743	650	7.260	34.212	2.46	127.4	1.9119
700	6.335	34.243	2.20	113.1	1.9621	700	6.675	34.179	2.36	122.2	2.0428	700	6.684	34.258	2.31	116.4	1.9782
750	5.835	34.284	2.04	104.2	2.0247	750	6.221	34.203	2.15	114.7	2.1071	750	6.213	34.295	2.17	107.8	2.0394
800	5.368	34.323	1.96	95.7	2.0760	800	5.628	34.244	1.86	104.6	2.1664	800	6.028	34.401	2.24	97.6	2.0956
850	4.863	34.322	1.90	89.7	2.1276	850	5.178	34.294	1.74	95.8	2.2218	850	5.060	34.367	1.97	89.0	2.1474
900	4.457	34.350	1.77	85.8	2.1150	900	4.773	34.337	1.69	88.1	2.2722	900	4.613	34.389	1.76	82.5	2.1948
950	4.227	34.407	1.70	77.3	2.2197	950	4.368	34.381	1.62	80.8	2.3196	950	4.507	34.436	2.00	77.9	2.2398
1000	4.019	34.470	1.74	70.4	2.2607	1000	4.094	34.412	1.65	75.5	2.3624	995	4.080	34.454	1.98	72.3	2.2776

Station	10	Depth	5500m
Date	Sep. 05 1986	Lat.	21-00.0 N
TIME	12:38	Long.	127-00.0 E
D	T	S	D.O.
m	C	m/l	c/l/t
0	29.544	34.524	4.17
10	29.463	34.521	3.93
20	29.355	34.518	3.92
30	29.315	34.524	3.78
50	28.902	34.592	3.79
75	25.007	34.817	3.85
100	23.292	34.920	3.75
125	21.083	34.914	3.62
150	21.161	34.913	3.54
175	20.385	34.892	3.47
200	19.002	34.909	3.38
250	18.108	34.855	3.30
350	15.438	34.701	3.47
400	14.023	34.576	3.39
450	12.542	34.454	3.27
500	10.010	34.334	3.40
550	9.411	34.260	2.87
600	7.992	34.226	2.56
650	7.275	34.203	2.49
700	6.335	34.243	2.20
750	5.835	34.284	2.04
800	5.368	34.323	1.96
850	4.863	34.322	1.90
900	4.457	34.350	1.77
950	4.227	34.407	1.70
1000	4.019	34.470	1.74

Station 21								Station 22								Station 23								Station 24							
Date Sep. 06 1986				Depth 6200m				Depth 2000m				Depth 1860m				Date Sep. 07 1986				Lat. 25°0'.1 N				Lat. 25°0'.1 N							
TIME 14:04				Lat. 23°59'.8 N				Long. 127°10'.3 E				TIME 22:00				Lat. 25°0'.1 N				TIME 12:04				Long. 127°10'.1 E							
D m	T C	S D.O.	Depth m	Dst C1/t	Dst C1/t	Del-D m	Dst C1/t	D m	T C	S D.O.	Depth m	Dst C1/t	Dst C1/t	Del-D m	D m	T C	S D.O.	Depth m	Dst C1/t	Dst C1/t	Del-D m	D m	T C	S D.O.	Depth m	Dst C1/t	Dst C1/t	Del-D m			
0	28.581	34.410	4.05	603.9	0.0000	0	28.555	34.523	4.21	594.9	0.0000	0	29.313	34.359	4.09	632.4	0.0000	0	29.313	34.359	4.09	632.4	0.0000	0	28.789	34.433	4.09	609.0	0.0640		
10	28.619	34.411	3.96	605.0	0.0633	10	28.401	34.527	4.15	589.8	0.0609	10	28.789	34.433	4.09	609.0	0.0640	10	28.456	34.484	4.00	594.6	0.1253	10	28.224	34.538	3.91	583.4	0.1817		
20	28.497	34.408	4.02	601.1	0.1213	20	28.230	34.517	4.07	585.4	0.1201	20	28.456	34.484	4.00	594.6	0.1253	20	27.755	34.538	3.92	583.8	0.2371	20	27.755	34.538	3.92	583.8	0.2371		
30	28.006	34.467	3.95	581.7	0.1920	30	27.722	34.627	4.00	561.4	0.1779	30	27.755	34.538	3.91	583.4	0.1817	30	27.755	34.538	3.92	583.8	0.2371	30	27.755	34.538	3.92	583.8	0.2371		
50	28.669	34.649	4.05	527.5	0.2918	50	26.926	34.624	4.07	537.1	0.2958	50	27.755	34.538	3.92	583.8	0.2371	50	27.755	34.538	3.92	583.8	0.2371	50	27.755	34.538	3.92	583.8	0.2371		
75	24.229	34.685	4.09	453.4	0.4149	75	21.962	34.819	4.29	381.3	0.4019	75	26.251	34.642	4.02	515.5	0.4880	75	26.251	34.642	4.02	515.5	0.4880	75	26.251	34.642	4.02	515.5	0.4880		
100	24.000	34.847	3.97	354.1	0.5179	100	20.563	34.868	4.01	341.2	0.4927	100	23.933	34.802	3.82	436.0	0.5561	100	23.933	34.802	3.82	436.0	0.5561	100	23.933	34.802	3.82	436.0	0.5561		
125	20.146	34.876	3.82	329.2	0.6043	125	19.904	34.870	3.89	324.4	0.5772	125	23.144	34.879	3.60	408.9	0.6605	125	23.144	34.879	3.60	408.9	0.6605	125	23.144	34.879	3.60	408.9	0.6605		
150	19.220	34.873	3.46	307.3	0.6840	150	19.162	34.873	3.71	305.9	0.6894	150	22.749	34.888	3.54	397.5	0.7836	150	22.749	34.888	3.54	397.5	0.7836	150	22.749	34.888	3.54	397.5	0.7836		
175	18.623	34.861	3.47	293.6	0.7606	175	18.358	34.850	3.66	288.2	0.7325	175	24.452	34.880	3.50	362.6	0.8599	175	24.452	34.880	3.50	362.6	0.8599	175	24.452	34.880	3.50	362.6	0.8599		
200	18.003	34.849	3.50	279.9	0.8337	200	17.744	34.833	3.66	275.0	0.8052	200	21.176	34.866	3.49	355.6	0.9515	200	21.176	34.866	3.49	355.6	0.9515	200	21.176	34.866	3.49	355.6	0.9515		
250	17.092	34.802	3.51	262.3	0.9742	250	16.809	34.794	3.63	256.5	0.9444	250	18.939	34.877	3.43	300.1	1.1189	250	18.939	34.877	3.43	300.1	1.1189	250	18.939	34.877	3.43	300.1	1.1189		
350	14.762	34.647	3.45	223.2	1.2245	350	14.682	34.633	3.56	222.6	1.1893	350	16.495	34.741	3.36	252.5	1.4048	350	16.495	34.741	3.36	252.5	1.4048	350	16.495	34.741	3.36	252.5	1.4048		
400	13.389	34.540	3.37	203.6	1.3366	400	13.107	34.516	3.44	200.0	1.3016	400	13.869	34.581	3.19	210.0	1.5566	400	13.869	34.581	3.19	210.0	1.5566	400	13.869	34.581	3.19	210.0	1.5566		
450	11.948	34.440	3.21	184.1	1.4306	450	11.939	34.423	3.35	185.1	1.4045	450	12.827	34.522	3.04	194.2	1.6323	450	12.827	34.522	3.04	194.2	1.6323	450	12.827	34.522	3.04	194.2	1.6323		
500	10.178	34.334	2.97	161.5	1.5309	500	10.404	34.349	3.04	164.1	1.4853	500	11.111	34.431	2.90	170.0	1.7288	500	11.111	34.431	2.90	170.0	1.7288	500	11.111	34.431	2.90	170.0	1.7288		
550	8.877	34.272	2.81	145.8	1.6133	550	8.923	34.288	2.71	145.3	1.5776	550	9.795	34.384	2.60	150.9	1.8456	550	9.795	34.384	2.60	150.9	1.8456	550	9.795	34.384	2.60	150.9	1.8456		
600	7.900	34.307	2.38	129.1	1.6870	600	7.671	34.249	2.51	130.1	1.6512	600	8.878	34.390	2.45	137.0	1.8831	600	8.878	34.390	2.45	137.0	1.8831	600	8.878	34.390	2.45	137.0	1.8831		
650	7.165	34.339	2.49	116.6	1.7533	650	6.778	34.337	2.06	114.7	1.768	650	7.611	34.384	2.23	119.5	1.9824	650	7.611	34.384	2.23	119.5	1.9824	650	7.611	34.384	2.23	119.5	1.9824		
700	6.579	34.366	2.04	107.0	1.8142	700	6.224	34.356	1.97	103.3	1.7753	700	6.946	34.393	2.08	109.7	2.0245	700	6.946	34.393	2.08	109.7	2.0245	700	6.946	34.393	2.08	109.7	2.0245		
750	5.772	34.368	1.97	95.5	1.8694	750	5.483	34.345	1.73	95.4	1.8289	750	6.351	34.409	1.98	100.9	2.0830	750	6.351	34.409	1.98	100.9	2.0830	750	6.351	34.409	1.98	100.9	2.0830		
800	5.160	34.400	1.87	87.6	1.9200	800	5.077	34.428	1.88	84.6	1.8787	800	5.755	34.425	1.88	92.5	2.1362	800	5.755	34.425	1.88	92.5	2.1362	800	5.755	34.425	1.88	92.5	2.1362		
850	4.563	34.417	1.77	79.9	1.9659	850	4.510	34.410	1.74	79.9	1.9246	850	5.448	34.454	1.82	88.3	2.1868	850	5.448	34.454	1.82	88.3	2.1868	850	5.448	34.454	1.82	88.3	2.1868		
900	4.158	34.452	1.94	73.1	2.0086	900	4.273	34.439	1.71	75.3	1.9675	900	5.167	34.442	1.79	84.6	2.2351	900	5.167	34.442	1.79	84.6	2.2351	900	5.167	34.442	1.79	84.6	2.2351		
950	3.934	34.474	1.91	69.3	2.0493	950	3.889	34.448	1.72	70.8	2.0076	950	4.994	34.446	1.79	82.3	2.2816	950	4.994	34.446	1.79	82.3	2.2816	950	4.994	34.446	1.79	82.3	2.2816		
1000	3.747	34.474	4.87	67.5	2.0872	1000	3.630	34.469	4.66	66.7	2.0460	1000	4.892	34.451	4.77	80.2	2.3230	1000	4.892	34.451	4.77	80.2	2.3230	1000	4.892	34.451	4.77	80.2	2.3230		

Station	24	Depth	2610m
Date	Sep. 07 1986	Lat.	23-59.9 N
TIME	20:02	Long.	124-44.6 E
D	T	S	Dst-D
m	C	m1/1	c1/t
0	29.108	34.620	4.06
10	29.091	34.609	4.11
20	29.119	34.633	3.98
30	28.950	34.608	3.95
50	27.713	34.533	4.02
75	26.025	34.651	3.97
100	24.469	34.830	3.86
125	22.969	34.860	3.73
150	21.744	34.861	3.60
175	20.524	34.889	3.53
200	19.507	34.866	3.46
250	17.660	34.854	3.49
350	15.728	34.775	3.66
400	14.532	34.624	3.67
450	13.240	34.506	3.63
500	11.943	34.430	3.37
550	10.036	34.298	3.26
600	8.630	34.241	2.87
650	8.179	34.378	2.45
700	6.921	34.352	2.29
750	6.105	34.332	2.19
800	5.505	34.422	2.13
850	5.257	34.456	2.20
900	4.053	34.479	2.25
950	4.527	34.499	2.35
995	4.132	34.524	2.27

Station	25	Depth	6160m
Date	Sep. 08 1986	Lat.	22-56.3 N
TIME	06:14	Long.	124-42.8 E
D	T	S	Dst-D
m	C	m1/1	c1/t
0	28.908	34.481	4.34
10	28.909	34.481	4.09
20	28.906	34.481	4.05
30	28.780	34.481	3.93
50	28.596	34.493	3.88
75	26.640	34.659	4.08
100	24.652	34.879	3.92
125	23.381	34.921	3.77
150	22.288	34.935	3.66
175	21.369	34.892	3.72
200	20.713	34.895	3.67
250	19.405	34.897	3.56
350	17.025	34.810	3.69
400	15.631	34.732	3.77
450	14.624	34.626	3.70
500	13.179	34.541	3.59
550	11.389	34.375	3.42
600	9.941	34.288	3.19
650	8.662	34.230	2.95
700	7.531	34.228	2.46
750	6.876	34.228	2.27
800	6.243	34.263	2.01
850	5.411	34.264	1.87
900	5.201	34.298	1.78
950	4.750	34.322	1.74
995	4.709	34.414	1.86

Station	26	Depth	5620m
Date	Sep. 08 1986	Lat.	22-00.0 N
TIME	12:11	Long.	124-45.0 E
D	T	S	Dst-D
m	C	m1/1	c1/t
0	29.036	34.565	4.02
10	28.965	34.565	3.98
20	28.925	34.564	3.92
30	28.754	34.569	3.78
50	26.566	34.587	3.68
75	23.542	34.919	3.75
100	21.909	34.997	3.66
125	21.136	34.971	3.72
150	20.600	34.968	3.78
175	20.366	34.971	3.75
200	20.258	34.874	3.74
250	19.959	34.867	3.78
350	17.170	34.816	3.84
400	16.462	34.792	4.01
450	15.865	34.747	3.97
500	15.324	34.697	3.85
550	14.213	34.592	3.76
600	12.483	34.459	3.81
650	10.652	34.325	3.38
700	9.272	34.248	3.14
750	7.593	34.205	2.81
800	6.467	34.182	2.57
850	5.587	34.208	2.29
900	4.960	34.262	1.99
950	4.692	34.305	1.82
1000	4.513	34.378	1.69

Station 28												Depth 970m											
Station 28						Depth 4780m						Station 28						Depth 970m					
Date Sep. 09 1986		Lat. 21°32.0' N		TIME 09:00		Lat. 21°32.0' N		TIME 15:35		Lat. 21°32.0' N		TIME 15:35		Lat. 21°32.0' N		TIME 15:35		Lat. 21°32.0' N		TIME 15:35		Lat. 21°32.0' N	
D	T	S	D.O.	Dst	De1-D	D	T	S	D.O.	Dst	De1-D	D	T	S	D.O.	Dst	De1-D	D	T	S	D.O.	Dst	De1-D
m	C		m1/l	c1/t		m	C		m1/l	c1/t		m	C		m1/l	c1/t		m	C		m1/l	c1/t	
0	29.566	34.512	4.04	626.0	0.0000	0	28.794	34.399	3.81	611.4	0.0000	0	30.175	34.381	3.87	657.3	0.0000	0	28.608	34.590	3.90	591.8	0.0639
10	29.500	34.530	3.74	624.6	0.0656	10	28.792	34.409	3.80	610.6	0.0638	10	28.608	34.590	3.90	591.8	0.0639	0	28.495	34.627	3.79	585.6	0.1255
20	29.039	34.539	3.67	609.2	0.1267	20	28.793	34.425	3.75	609.5	0.1249	20	28.341	34.666	3.76	577.9	0.1800	30	28.242	34.720	3.70	509.6	0.2902
30	29.109	34.535	3.61	611.7	0.1076	30	28.792	34.429	3.79	609.2	0.1853	30	28.242	34.720	3.70	509.6	0.2902	50	28.792	34.430	3.76	609.1	0.3065
50	28.852	34.512	3.53	605.1	0.3095	50	28.792	34.430	3.76	609.1	0.3065	50	28.242	34.720	3.70	509.6	0.2902	75	28.608	34.590	3.90	591.8	0.0639
75	26.452	34.744	3.67	514.1	0.4506	75	27.901	34.715	3.85	560.6	0.4536	75	24.325	34.861	3.70	443.3	0.4128	125	24.876	34.926	3.42	371.2	0.6133
100	24.970	34.819	3.34	461.9	0.5724	100	26.360	34.857	3.83	503.2	0.5683	100	22.751	34.917	3.48	395.4	0.5156	150	24.238	34.911	3.39	355.5	0.7067
125	23.313	34.936	3.24	411.0	0.6631	125	25.403	34.926	3.71	469.8	0.7119	125	21.876	34.926	3.42	371.2	0.6133	175	19.291	34.887	3.34	308.0	0.7911
150	21.562	34.883	3.14	366.0	0.7045	150	24.453	34.969	3.58	439.2	0.8258	150	21.238	34.911	3.39	355.5	0.7067	200	17.083	34.744	3.24	266.3	0.8635
175	20.531	34.863	3.24	340.7	0.8722	175	23.326	34.975	3.48	407.0	0.9345	175	19.291	34.887	3.34	308.0	0.7911	250	15.587	34.703	3.17	236.4	0.9916
200	20.105	34.870	3.22	329.4	0.9582	200	22.083	34.951	3.45	374.9	1.0320	200	17.083	34.744	3.24	266.3	0.8635	300	13.172	34.523	3.05	200.7	1.2192
250	18.905	34.864	3.09	300.5	1.1486	250	19.334	34.882	3.43	309.3	1.2089	250	15.587	34.703	3.17	236.4	0.9916	400	11.302	34.446	2.66	172.2	1.3164
350	16.369	34.762	3.24	248.8	1.4036	350	15.844	34.722	3.35	239.9	1.4929	350	13.172	34.523	3.05	200.7	1.2192	450	9.841	34.410	2.46	150.4	1.4015
400	15.512	34.705	3.31	234.6	1.5289	400	14.478	34.617	3.29	219.6	1.6136	400	11.302	34.446	2.66	172.2	1.3164	500	8.782	34.440	2.46	131.9	1.4768
450	14.407	34.619	3.33	218.0	1.6476	450	13.227	34.511	3.22	202.6	1.7243	450	10.486	34.315	3.00	167.7	1.8225	500	8.182	34.445	2.05	122.7	1.5450
500	13.192	34.528	3.33	200.7	1.7592	500	10.466	34.275	2.68	154.3	1.9083	500	8.182	34.445	2.05	122.7	1.5450	550	9.448	34.352	1.83	102.5	2.1843
550	11.205	34.350	3.14	177.6	1.8599	550	9.431	34.256	2.36	140.4	1.9872	550	6.076	34.492	2.14	87.2	1.8309	600	8.431	34.375	1.79	89.0	2.2393
600	9.727	34.274	2.92	158.7	1.9496	600	7.448	34.283	2.14	126.0	2.0582	600	5.326	34.406	1.79	83.2	2.3386	650	7.221	34.454	2.09	108.8	1.6744
650	8.472	34.207	2.79	144.6	2.0348	650	6.904	34.282	2.02	116.6	2.1244	650	6.619	34.468	2.11	99.9	1.7286	700	6.619	34.468	2.11	99.9	1.7286
700	7.351	34.178	2.55	131.1	2.1059	700	6.394	34.282	2.02	116.6	2.1244	700	6.619	34.468	2.11	99.9	1.7286	750	6.076	34.478	2.13	92.4	1.7813
750	6.490	34.178	2.32	120.1	2.1739	750	6.132	34.352	1.83	102.5	2.1843	750	6.076	34.478	2.13	92.4	1.7813	800	5.734	34.492	2.14	87.2	1.8309
800	5.801	34.205	2.08	110.5	2.2370	800	5.813	34.375	1.79	97.0	2.2393	800	5.529	34.490	2.19	85.0	1.8796	850	5.307	34.245	1.86	95.1	2.20
850	4.960	34.274	1.81	100.9	2.2951	850	4.980	34.432	1.79	89.0	2.2909	850	5.061	34.514	2.20	77.9	1.9204	900	4.960	34.276	1.81	94.8	2.2380
900	4.540	34.343	1.54	85.3	2.3985	900	4.525	34.461	1.80	76.2	2.3830	900	4.370	34.460	1.83	73.2	2.2123	950	4.293	34.374	1.51	80.4	2.4398
950	4.293	34.374	1.51	80.4	2.4398	950	4.370	34.460	1.83	73.2	2.2123	950	—	—	—	—	—	995	—	—	—	—	—

Station	30	Depth	3400m	Station	31	Depth	4830m
Date	Sep. 09 1986	Lat.	21°32'.3 N	Date	Sep. 11 1986	Lat.	22°02'.4 N
TIME	04:55	Long.	119°58'.2 E	TIME	07:30	Long.	122°24'.9 E
D	T	S	D.O.	D	T	S	D.O.
m	C	m1/1	c1/t	m	C	m1/1	c1/t
0	28.815	33.820	4.09	0	28.978	34.381	3.88
10	28.815	33.855	4.00	10	28.970	34.378	3.72
20	28.010	33.867	4.04	20	28.898	34.367	3.73
30	20.759	33.868	4.03	30	28.769	34.349	3.67
50	28.733	33.874	3.98	50	28.614	34.355	3.63
75	28.525	33.871	3.97	75	28.177	34.548	3.61
100	26.203	34.296	3.97	100	26.178	34.906	3.61
125	23.502	34.589	3.59	125	25.146	34.947	3.39
150	21.476	34.648	3.29	150	23.497	34.986	3.33
175	20.293	34.662	3.21	175	24.763	34.959	3.32
200	18.699	34.713	3.12	200	20.789	34.936	3.23
250	15.606	34.634	2.93	250	18.893	34.883	3.23
350	11.406	34.483	2.38	350	16.121	34.736	3.26
400	10.394	34.447	2.36	400	14.851	34.643	3.29
450	9.082	34.452	2.28	450	11.914	34.405	3.08
500	9.103	34.439	2.16	500	10.902	34.344	2.94
550	8.354	34.437	2.07	550	10.042	34.296	2.80
600	7.784	34.449	2.02	600	9.034	34.254	2.24
650	7.391	34.464	1.94	650	7.123	34.200	1.93
700	7.097	34.470	1.89	700	6.478	34.332	1.82
750	6.693	34.474	1.97	750	6.057	34.371	1.76
800	6.217	34.484	1.96	800	5.929	34.387	1.78
850	5.887	34.494	2.05	850	5.652	34.406	1.60
900	5.554	34.509	2.07	900	5.354	34.427	1.80
950	5.213	34.517	2.09	950	5.164	34.442	1.81
1000	5.029	34.523	2.16	995	5.024	34.450	1.84

Station	30	Depth	3400m	Station	31	Depth	4830m
Date	Sep. 09 1986	Lat.	21°32'.3 N	Date	Sep. 11 1986	Lat.	22°02'.4 N
TIME	04:55	Long.	119°58'.2 E	TIME	07:30	Long.	122°24'.9 E
D	T	S	D.O.	D	T	S	D.O.
m	C	m1/1	c1/t	m	C	m1/1	c1/t
0	28.815	33.820	4.09	0	28.978	34.381	3.88
10	28.815	33.855	4.00	10	28.970	34.378	3.72
20	28.010	33.867	4.04	20	28.898	34.367	3.73
30	20.759	33.868	4.03	30	28.769	34.349	3.67
50	28.733	33.874	3.98	50	28.614	34.355	3.63
75	28.525	33.871	3.97	75	28.177	34.548	3.61
100	26.203	34.296	3.97	100	26.178	34.906	3.61
125	23.502	34.589	3.59	125	25.146	34.947	3.39
150	21.476	34.648	3.29	150	23.497	34.986	3.33
175	20.293	34.662	3.21	175	24.763	34.959	3.32
200	18.699	34.713	3.12	200	20.789	34.936	3.23
250	15.606	34.634	2.93	250	18.893	34.883	3.23
350	11.406	34.483	2.38	350	16.121	34.736	3.26
400	10.394	34.447	2.36	400	14.851	34.643	3.29
450	9.082	34.452	2.28	450	11.914	34.405	3.08
500	9.103	34.439	2.16	500	10.902	34.344	2.94
550	8.354	34.437	2.07	550	10.042	34.296	2.80
600	7.784	34.449	2.02	600	9.034	34.254	2.24
650	7.391	34.464	1.94	650	7.123	34.200	1.93
700	7.097	34.470	1.89	700	6.478	34.332	1.82
750	6.693	34.474	1.97	750	6.057	34.371	1.76
800	6.217	34.484	1.96	800	5.929	34.387	1.78
850	5.887	34.494	2.05	850	5.652	34.406	1.60
900	5.554	34.509	2.07	900	5.354	34.427	1.80
950	5.213	34.517	2.09	950	5.164	34.442	1.81
1000	5.029	34.523	2.16	995	5.024	34.450	1.84

Station	30	Depth	3400m	Station	32	Depth	4830m
Date	Sep. 09 1986	Lat.	21°32'.3 N	Date	Sep. 11 1986	Lat.	22°00'.1 N
TIME	04:55	Long.	119°58'.2 E	TIME	07:30	Long.	122°20'.3 E
D	T	S	D.O.	D	T	S	D.O.
m	C	m1/1	c1/t	m	C	m1/1	c1/t
0	28.815	33.820	4.09	0	28.978	34.381	3.88
10	28.815	33.855	4.00	10	28.970	34.378	3.72
20	28.010	33.867	4.04	20	28.898	34.367	3.73
30	20.759	33.868	4.03	30	28.769	34.349	3.67
50	28.733	33.874	3.98	50	28.614	34.355	3.63
75	28.525	33.871	3.97	75	28.177	34.548	3.61
100	26.203	34.296	3.97	100	26.178	34.906	3.61
125	23.502	34.589	3.59	125	25.146	34.947	3.39
150	21.476	34.648	3.29	150	23.497	34.986	3.33
175	20.293	34.662	3.21	175	24.763	34.959	3.32
200	18.699	34.713	3.12	200	20.789	34.936	3.23
250	15.606	34.634	2.93	250	18.893	34.883	3.23
350	11.406	34.483	2.38	350	16.121	34.736	3.26
400	10.394	34.447	2.36	400	14.851	34.643	3.29
450	9.082	34.452	2.28	450	11.914	34.405	3.08
500	9.103	34.439	2.16	500	10.902	34.344	2.94
550	8.354	34.437	2.07	550	10.042	34.296	2.80
600	7.784	34.449	2.02	600	9.034	34.254	2.24
650	7.391	34.464	1.94	650	7.123	34.200	1.93
700	7.097	34.470	1.89	700	6.478	34.332	1.82
750	6.693	34.474	1.97	750	6.057	34.371	1.76
800	6.217	34.484	1.96	800	5.929	34.387	1.78
850	5.887	34.494	2.05	850	5.652	34.406	1.60
900	5.554	34.509	2.07	900	5.354	34.427	1.80
950	5.213	34.517	2.09	950	5.164	34.442	1.81
1000	5.029	34.523	2.16	995	5.024	34.450	1.84

Station 34				Depth 1000m				Station B				Depth 1680m							
Date	Sep. 11 1986	Lat.	24°00.5 N	Date	Sep. 12 1986	Lat.	25°06.9 N	Date	Sep. 12 1986	Lat.	24°46.6 N	TIME	06:54	Long.	122°27.3 E	TIME	18:15	Long.	123°16.4 E
D	T	S	O.O.	D	T	S	O.O.	D	T	S	O.O.	D	T	S	O.O.	Del-D			
m	C	gl/1	cl/t	m	C	gl/1	cl/t	m	C	gl/1	cl/t	m	C	gl/1	cl/t				
0	28.276	33.770	4.22	640.4	0.0000	0	28.236	33.948	4.05	626.2	0.0000	0	29.220	33.457	3.88	682.8	0.0000		
10	27.965	34.176	4.18	601.4	0.0641	10	28.233	33.950	4.05	626.0	0.0640	10	28.705	33.548	3.88	689.9	0.0709		
20	27.407	34.261	4.10	578.0	0.1236	20	27.623	34.048	4.05	600.0	0.1260	20	28.292	33.588	3.75	683.9	0.1358		
30	26.915	34.431	3.96	550.7	0.1798	30	27.191	34.192	4.07	576.3	0.1830	30	27.854	33.870	3.78	613.7	0.2004		
50	26.461	34.557	3.92	527.8	0.2802	50	25.995	34.372	4.00	527.2	0.2851	50	27.457	34.287	3.63	569.9	0.3166		
75	25.710	34.684	3.85	496.3	0.4150	75	24.355	34.493	3.78	470.8	0.4210	75	26.34	34.419	3.72	533.4	0.4563		
100	24.565	34.749	3.73	458.3	0.5362	100	21.835	34.556	3.38	396.9	0.5292	100	25.304	34.524	3.53	486.0	0.5861		
125	22.309	34.884	3.55	385.8	0.6436	125	20.068	34.595	3.27	348.5	0.6534	125	23.928	34.729	3.49	444.6	0.7073		
150	20.442	34.808	3.40	342.4	0.7342	150	18.742	34.562	3.24	318.3	0.7082	150	22.756	34.793	3.37	404.5	0.8440		
175	18.570	34.748	3.36	300.7	0.8176	175	17.915	34.663	3.25	291.4	0.7655	175	21.531	34.878	3.34	365.5	0.9092		
200	17.385	34.729	3.23	274.3	0.8916	200	17.206	34.675	3.24	274.2	0.8884	200	20.652	34.883	3.28	341.8	0.9990		
250	14.982	34.649	3.15	227.6	1.0203	250	14.423	34.610	3.03	219.0	0.9845	250	17.479	34.781	3.23	272.6	1.1577		
350	11.685	34.499	2.67	175.0	1.2286	350	12.319	34.525	2.96	184.5	1.1942	350	13.466	34.547	2.98	204.6	1.4045		
400	9.956	34.425	2.50	151.2	1.3130	400	11.409	34.469	2.89	170.9	1.2876	400	11.794	34.451	2.82	180.5	1.5049		
450	9.013	34.414	2.36	137.3	1.3906	450	10.467	34.451	2.78	157.6	1.3741	450	10.979	34.405	2.74	169.6	1.5977		
500	8.234	34.394	2.27	127.2	1.4610	500	8.393	34.420	2.38	127.6	1.4614	500	9.906	34.367	2.59	154.7	1.8846		
550	7.723	34.410	2.27	118.8	1.5271	550	7.114	34.431	2.11	109.1	1.5148	550	8.950	34.377	2.40	189.1	1.7631		
600	7.183	34.415	2.25	111.2	1.5880	600	6.637	34.428	2.04	103.1	1.5523	600	8.012	34.369	2.23	126.7	1.8340		
650	6.378	34.421	2.13	100.4	1.6462	650	6.265	34.426	2.10	98.6	1.6564	650	7.248	34.360	2.11	145.8	1.8998		
700	6.178	34.433	2.18	97.0	1.7066	700	5.734	34.420	2.48	92.7	1.6785	700	6.393	34.385	1.97	103.1	1.9590		
750	5.684	34.436	2.08	90.9	1.7520	750	5.474	34.431	2.56	88.9	1.7289	750	5.800	34.413	1.89	94.0	2.0133		
800	5.274	34.437	2.03	86.1	1.8012	800	5.250	34.433	2.32	86.1	1.7774	800	5.507	34.425	1.87	89.6	2.0645		
850	4.925	34.477	2.08	79.3	1.8473	850	5.104	34.439	2.06	84.1	1.8239	850	5.225	34.436	1.79	86.1	2.1131		
900	4.689	34.490	2.10	75.8	1.8907	900	4.905	34.442	1.93	81.6	1.8701	900	4.926	34.447	1.73	81.5	2.1601		
950	4.462	34.505	2.18	72.3	1.9323	900	4.905	34.442	1.93	81.6	1.8704	950	4.757	34.452	1.74	79.3	2.2052		
1000	4.003	34.514	2.21	67.7	1.9716							1000	4.518	34.459	1.68	76.3	2.2485		

Station	33	Depth	3400m	Station	34	Depth	1000m	Station	B	Depth	1680m	
Date	Sep. 11 1986	Lat.	24°00.5 N	Date	Sep. 12 1986	Lat.	25°06.9 N	Date	Sep. 12 1986	Lat.	24°46.6 N	
TIME	21:18	Long.	122°20.0 E	TIME	06:54	Long.	122°27.3 E	TIME	18:15	Long.	123°16.4 E	
D	T	S	O.O.	D	T	S	O.O.	D	T	S	O.O.	
m	C	gl/1	cl/t	m	C	gl/1	cl/t	m	C	gl/1	cl/t	
0	28.276	33.770	4.22	640.4	0.0000	0	28.236	33.948	4.05	626.2	0.0000	
10	27.965	34.176	4.18	601.4	0.0641	10	28.233	33.950	4.05	626.0	0.0640	
20	27.407	34.261	4.10	578.0	0.1236	20	27.623	34.048	4.05	600.0	0.1260	
30	26.915	34.431	3.96	550.7	0.1798	30	27.191	34.192	4.07	576.3	0.1830	
50	26.461	34.557	3.92	527.8	0.2802	50	25.995	34.372	4.00	527.2	0.2851	
75	25.710	34.684	3.85	496.3	0.4150	75	24.355	34.493	3.78	470.8	0.4210	
100	24.565	34.749	3.73	458.3	0.5362	100	21.835	34.556	3.38	396.9	0.5292	
125	22.309	34.884	3.55	385.8	0.6436	125	20.068	34.595	3.27	348.5	0.6534	
150	20.442	34.808	3.40	342.4	0.7342	150	18.742	34.562	3.24	318.3	0.7082	
175	18.570	34.748	3.36	300.7	0.8176	175	17.915	34.663	3.25	291.4	0.7655	
200	17.385	34.729	3.23	274.3	0.8916	200	17.206	34.675	3.24	274.2	0.8884	
250	14.982	34.649	3.15	227.6	1.0203	250	14.423	34.610	3.03	219.0	0.9845	
350	11.685	34.499	2.67	175.0	1.2286	350	12.319	34.525	2.96	184.5	1.1942	
400	9.956	34.425	2.50	151.2	1.3130	400	11.409	34.469	2.89	170.9	1.2876	
450	9.013	34.414	2.36	137.3	1.3906	450	10.467	34.451	2.78	157.6	1.3741	
500	8.234	34.394	2.27	127.2	1.4610	500	8.393	34.420	2.38	127.6	1.4614	
550	7.723	34.410	2.27	118.8	1.5271	550	7.114	34.431	2.11	109.1	1.5148	
600	7.183	34.415	2.25	111.2	1.5880	600	6.637	34.428	2.04	103.1	1.5523	
650	6.378	34.421	2.13	100.4	1.6462	650	6.265	34.426	2.10	98.6	1.6564	
700	6.178	34.433	2.18	97.0	1.7066	700	5.734	34.420	2.48	92.7	1.6785	
750	5.684	34.436	2.08	90.9	1.7520	750	5.474	34.431	2.56	88.9	1.7289	
800	5.274	34.437	2.03	86.1	1.8012	800	5.250	34.433	2.32	86.1	1.7774	
850	4.925	34.477	2.08	79.3	1.8473	850	5.104	34.439	2.06	84.1	1.8239	
900	4.689	34.490	2.10	75.8	1.8907	900	4.905	34.442	1.93	81.6	1.8701	
950	4.462	34.505	2.18	72.3	1.9323	900	4.905	34.442	1.93	81.6	1.8704	
1000	4.003	34.514	2.21	67.7	1.9716							

Station C3						Station 5530m											
Date	Sep. 22 1986	Lat.	18°59'.6 N	Depth	5480m	Date	Sep. 22 1986	Lat.	19°03'.8 N	Depth	5530m						
TIME	08:35	Long.	129°33'.1 E	TIME	12:01	TIME	16:00	Long.	128°28'.0 E	TIME							
D	T	S	D.O.	Dst	Del-D	D	T	S	D.O.	Dst	Del-D						
m	C		m1/1	c1/t		m	C		m1/1	c1/t							
0	28.316	34.529	4.29	587.0	0.0000	0	28.448	34.578	4.41	587.6	0.0000	0	28.796	34.650	4.54	593.4	0.0000
10	28.298	34.518	4.40	585.8	0.0595	10	28.258	34.574	4.48	581.9	0.0589	10	28.484	34.630	4.37	585.0	0.0611
20	28.293	34.601	4.33	585.1	0.1189	20	28.158	34.581	4.51	578.3	0.1173	20	28.309	34.639	4.33	578.8	0.1172
30	28.238	34.618	4.30	578.1	0.1771	30	28.093	34.584	4.49	576.0	0.1761	30	28.274	34.637	4.35	577.9	0.1767
50	28.122	34.594	4.30	576.2	0.2937	50	28.053	34.583	4.40	575.1	0.2915	50	28.246	34.636	4.33	577.1	0.2914
75	25.298	34.883	4.43	469.8	0.4240	75	28.033	34.585	4.27	574.1	0.4360	75	27.084	34.784	4.35	530.4	0.4302
100	23.939	35.018	4.04	421.1	0.5558	100	25.306	34.980	4.21	463.1	0.5656	100	24.826	35.004	4.17	447.4	0.5552
125	22.659	34.985	3.91	367.3	0.6372	125	24.309	35.004	3.96	432.6	0.6797	125	23.675	35.012	3.95	414.1	0.6622
150	21.180	34.976	3.83	349.3	0.7320	150	22.989	35.006	3.88	395.5	0.7833	150	22.532	34.981	3.91	384.8	0.7633
175	19.682	34.919	3.80	320.3	0.8162	175	21.868	34.989	3.66	366.4	0.8798	175	20.864	34.940	3.81	343.7	0.8588
200	18.681	34.877	3.85	293.9	0.8943	200	20.344	34.939	3.74	330.5	0.9686	200	19.824	34.924	3.73	318.5	0.9440
250	17.038	34.806	3.98	260.6	1.0371	250	17.730	34.838	3.61	274.3	1.1240	250	17.724	34.841	3.80	273.8	1.0931
350	14.377	34.588	3.98	219.0	1.2058	350	14.957	34.650	3.58	227.0	1.3831	350	14.627	34.613	3.78	222.9	1.3507
400	12.611	34.453	3.68	195.2	1.3950	400	12.859	34.469	3.33	200.6	1.4964	400	12.186	34.419	3.42	189.9	1.4593
450	10.804	34.355	3.43	171.8	1.4905	450	11.012	34.339	3.06	175.1	1.5947	450	10.878	34.335	3.21	173.1	1.5548
500	9.223	34.262	3.14	151.8	1.5770	500	9.320	34.256	2.81	153.7	1.6825	500	9.409	34.262	2.92	154.6	1.6445
550	7.779	34.230	2.48	133.0	1.6526	550	8.126	34.218	2.37	138.8	1.7595	550	8.152	34.236	2.42	137.8	1.7187
600	7.009	34.252	2.13	121.0	1.7209	600	7.124	34.238	1.94	123.5	1.8302	600	7.348	34.234	2.08	126.9	1.7903
650	6.430	34.303	1.79	109.9	1.7824	650	6.470	34.281	1.62	112.0	1.8931	650	6.772	34.289	1.59	115.2	1.8547
700	5.879	34.325	1.65	101.5	1.8396	700	5.713	34.292	1.50	102.0	1.9521	700	6.268	34.314	1.58	107.3	1.9461
750	5.047	34.327	1.53	91.8	1.8922	750	5.037	34.335	1.42	91.2	2.0041	750	5.416	34.300	1.51	98.0	1.9746
800	4.877	34.403	1.56	84.3	1.9405	800	4.781	34.407	1.46	83.0	2.0516	800	5.100	34.373	1.47	89.0	2.0229
850	4.510	34.436	1.60	77.9	1.9860	850	4.519	34.443	1.52	77.5	2.0957	850	4.794	34.406	1.51	83.2	2.0698
900	4.316	34.466	1.68	73.6	2.0276	900	4.236	34.473	1.59	72.4	2.1373	900	4.593	34.430	1.54	79.3	2.1151
950	4.104	34.511	1.88	68.9	2.0678	950	4.152	34.519	1.80	68.0	2.1773	950	4.329	34.461	1.59	74.2	2.1578
1000	3.938	34.537	1.99	64.6	2.1059	1000	3.912	34.522	1.83	65.4	2.2145	1000	4.158	34.516	1.81	68.4	2.1982

Station	C1	Depth	5600m	Station	C2	Depth	5480m										
Date	Sep. 22 1986	Lat.	18°59'.6 N	Date	Sep. 22 1986	Lat.	19°00'.7 N										
TIME	06:35	Long.	129°33'.1 E	TIME	12:01	Long.	129°28'.2 E										
D	T	S	D.O.	Dst	Del-D	D	T										
m	C		m1/1	c1/t		m	C										
0	28.316	34.529	4.29	587.0	0.0000	0	28.448	34.578	4.41	587.6	0.0000	0	28.796	34.650	4.54	593.4	0.0000
10	28.298	34.518	4.40	585.8	0.0595	10	28.258	34.574	4.48	581.9	0.0589	10	28.484	34.630	4.37	585.0	0.0611
20	28.293	34.601	4.33	585.1	0.1189	20	28.158	34.581	4.51	578.3	0.1173	20	28.309	34.639	4.33	578.8	0.1172
30	28.238	34.618	4.30	578.1	0.1771	30	28.093	34.584	4.49	576.0	0.1761	30	28.274	34.637	4.35	577.9	0.1767
50	28.122	34.594	4.30	576.2	0.2937	50	28.053	34.583	4.40	575.1	0.2915	50	28.246	34.636	4.33	577.1	0.2914
75	25.298	34.883	4.43	469.8	0.4240	75	28.033	34.585	4.27	574.1	0.4360	75	27.084	34.784	4.35	530.4	0.4302
100	23.939	35.018	4.04	421.1	0.5558	100	25.306	34.980	4.21	463.1	0.5656	100	24.826	35.004	4.17	447.4	0.5552
125	22.659	34.985	3.91	367.3	0.6372	125	24.309	35.004	3.96	432.6	0.6797	125	23.675	35.012	3.95	414.1	0.6622
150	21.180	34.976	3.83	349.3	0.7320	150	22.989	35.006	3.88	395.5	0.7833	150	22.532	34.981	3.91	384.8	0.7633
175	19.682	34.919	3.80	320.3	0.8162	175	21.868	34.989	3.66	366.4	0.8798	175	20.864	34.940	3.81	343.7	0.8588
200	18.681	34.877	3.85	293.9	0.8943	200	20.344	34.939	3.74	330.5	0.9686	200	19.824	34.924	3.73	318.5	0.9440
250	17.038	34.806	3.98	260.6	1.0371	250	17.730	34.838	3.61	274.3	1.1240	250	17.724	34.841	3.80	273.8	1.0931
350	14.377	34.588	3.98	219.0	1.2058	350	14.957	34.650	3.58	227.0	1.3831	350	14.627	34.613	3.78	222.9	1.3507
400	12.611	34.453	3.68	195.2	1.3950	400	12.859	34.469	3.33	200.6	1.4964	400	12.186	34.419	3.42	189.9	1.4593
450	10.804	34.355	3.43	171.8	1.4905	450	11.012	34.339	3.06	175.1	1.5947	450	10.878	34.335	3.21	173.1	1.5548
500	9.223	34.262	3.14	151.8	1.5770	500	9.320	34.256	2.81	153.7	1.6825	500	9.409	34.262	2.92	154.6	1.6445
550	7.779	34.230	2.48	133.0	1.6526	550	8.126	34.218	2.37	138.8	1.7595	550	8.152	34.236	2.42	137.8	1.7187
600	7.009	34.252	2.13	121.0	1.7209	600	7.124	34.238	1.94	123.5	1.8302	600	7.348	34.234	2.08	126.9	1.7903
650	6.430	34.303	1.79	109.9	1.7824	650	6.470	34.281	1.62	112.0	1.8931	650	6.772	34.289	1.59	115.2	1.8547
700	5.879	34.325	1.65	101.5	1.8396	700	5.713	34.292	1.50	102.0	1.9521	700	6.268	34.314	1.58	107.3	1.9461
750	5.047	34.327	1.53	91.8	1.8922	750	5.037	34.335	1.42	91.2	2.0041	750	5.416	34.300	1.51	98.0	1.9746
800	4.877	34.403	1.56	84.3	1.9405	800	4.781	34.407	1.46	83.0	2.0516	800	5.100	34.373	1.47	89.0	2.0229
850	4.510	34.436	1.60	77.9	1.9860	850	4.519	34.443	1.52	77.5	2.0957	850	4.794	34.406	1.51	83.2	2.0698
900	4.316	34.466	1.68	73.6	2.0276	900	4.236	34.473	1.59	72.4	2.1373	900	4.593	34.430	1.54	79.3	2.1151
950	4.104	34.511	1.88	68.9	2.0678	950	4.152	34.519	1.80	68.0	2.1773	950	4.329	34.461	1.59	74.2	2.1578
1000	3.938	34.537	1.99	64.6	2.1059	1000	3.912	34.522	1.83	65.4	2.2145	1000	4.158	34.516	1.81	68.4	2.1982

Station C6								Station 5330m									
Date	Sep. 22 1986	Lat.	19-05.0 N	Date	Sep. 22 1986	Lat.	19-03.9 N	Date	Sep. 22 1986	Lat.	19-03.9 N	Date	Sep. 22 1986	Lat.	19-03.9 N		
TIME	17:59	Long.	129-30.8 E	TIME	18:03	Long.	129-32.4 E	TIME	20:13	Long.	129-28.8 E	TIME	20:13	Long.	129-28.8 E		
D	T	S	Dst	D	T	S	Dst	D	T	S	Dst	D	T	S	Dst		
m	C	mI/t	cI/t	m	C	mI/t	cI/t	m	C	mI/t	cI/t	m	C	mI/t	cI/t		
0	28.707	34.662	4.49	590.5	0.0000	0	28.707	34.652	4.49	590.5	0.0000	0	28.476	34.640	4.33	584.0	0.0000
10	28.466	34.633	4.53	584.3	0.0603	10	28.468	34.633	4.53	584.3	0.0603	10	28.598	34.635	4.35	566.3	0.0592
20	28.298	34.619	4.33	579.6	0.1190	20	28.288	34.619	4.33	579.6	0.1190	20	28.302	34.638	4.32	576.7	0.1216
30	28.298	34.626	4.36	578.4	0.1755	30	28.266	34.626	4.36	578.4	0.1755	30	28.278	34.637	4.23	578.0	0.1771
50	28.251	34.657	4.28	577.2	0.2935	50	28.251	34.637	4.28	577.2	0.2935	50	28.250	34.635	4.22	577.3	0.2947
75	26.592	34.651	4.40	510.6	0.4280	75	26.592	34.851	4.40	510.6	0.4280	75	25.942	34.899	4.22	487.7	0.4275
100	24.676	34.987	4.24	444.3	0.5499	100	24.676	34.987	4.24	444.3	0.5499	100	23.733	35.002	3.91	416.5	0.5441
125	23.396	35.024	3.96	405.2	0.6559	125	23.386	35.024	3.96	405.2	0.6559	125	22.698	35.024	3.66	386.2	0.6417
150	22.171	35.093	3.87	373.5	0.7542	150	22.171	35.003	3.87	373.5	0.7542	150	21.719	35.005	3.54	361.3	0.7368
175	20.474	34.940	3.88	339.7	0.8457	175	20.474	34.940	3.88	333.7	0.8457	175	20.551	34.945	3.55	335.3	0.8280
200	19.452	34.908	3.80	310.4	0.9273	200	19.452	34.908	3.80	310.4	0.9273	200	19.476	34.917	3.54	310.3	0.9088
250	17.719	34.841	3.85	274.5	1.0779	250	17.749	34.841	3.85	274.5	1.0779	250	17.697	34.839	3.60	273.4	1.0569
350	14.867	34.637	3.82	226.1	1.3361	350	14.887	34.637	3.82	226.1	1.3361	350	14.669	34.619	3.56	223.3	1.3139
400	12.810	34.480	3.53	198.4	1.4480	400	12.810	34.480	3.53	198.4	1.4480	400	12.570	34.443	3.27	195.2	1.4246
450	11.221	34.363	3.24	176.9	1.5466	450	11.221	34.363	3.24	176.9	1.5466	450	10.874	34.342	3.07	172.5	1.5213
500	9.791	34.271	3.09	160.0	1.6861	500	9.791	34.271	3.09	160.0	1.6861	500	9.342	34.264	2.77	153.5	1.6074
550	8.751	34.248	2.70	145.7	1.7179	550	8.751	34.248	2.70	145.7	1.7179	550	8.060	34.233	2.37	136.7	1.6863
600	7.500	34.240	2.24	128.5	1.7904	600	7.500	34.240	2.24	128.5	1.7904	600	6.950	34.252	1.92	120.3	1.7531
650	6.899	34.260	1.86	117.5	1.8572	650	6.899	34.280	1.86	117.5	1.8572	650	6.487	34.302	1.63	110.6	1.8154
700	6.432	34.311	1.68	109.2	1.9189	700	6.432	34.311	1.68	109.2	1.9189	700	5.827	34.303	1.70	102.5	1.8732
750	5.879	34.320	1.60	104.9	1.9762	750	5.879	34.320	1.60	101.9	1.9762	750	5.169	34.331	1.66	92.9	1.9266
800	5.040	34.341	1.51	90.7	2.0294	800	5.040	34.341	1.51	90.7	2.0294	800	5.028	34.392	1.73	86.8	1.9761
850	4.975	34.350	1.56	86.3	2.0773	850	4.975	34.350	1.56	86.3	2.0773	850	4.769	34.413	1.70	82.4	2.0226
900	4.722	34.411	1.59	82.0	2.1244	900	4.722	34.411	1.59	82.0	2.1244	900	4.508	34.438	1.68	77.9	2.0669
950	4.434	34.441	1.64	76.8	2.1692	950	4.434	34.441	1.64	76.8	2.1692	950	4.243	34.473	1.69	72.4	2.1089
1000	4.203	34.477	1.74	71.7	2.2103	1000	4.203	34.477	1.74	71.7	2.2103	1000	4.085	34.526	1.88	66.9	2.1485

Station C4	Depth	5390m	Station C5	Depth	5320m
Date	Sep. 22 1986	Lat.	Sep. 22 1986	Lat.	Sep. 22 1986
TIME	17:59	Long.	18:03	Long.	18:03
D	T	S	D	T	S
m	C	mI/t	m	C	mI/t
0	28.707	34.662	3.09	160.0	1.6861
10	28.466	34.633	4.53	145.7	1.7179
20	28.298	34.619	4.33	128.5	1.7904
30	28.298	34.626	4.36	117.5	1.8572
50	28.251	34.657	4.28	104.9	1.9762
75	26.592	34.651	4.40	90.7	2.0294
100	24.676	34.987	4.24	86.3	2.0773
125	23.396	35.024	3.96	82.0	2.1244
150	22.171	35.093	3.87	76.8	2.1692
175	20.474	34.940	3.88	71.7	2.2103
200	19.452	34.908	3.80	69.0	2.2471
250	17.719	34.841	3.85	64.8	2.3191
350	14.867	34.637	3.82	59.6	2.4089
400	12.810	34.480	3.53	53.3	2.4880
450	11.221	34.363	3.24	46.8	2.5531
500	9.791	34.271	3.09	40.0	2.6161
550	8.751	34.248	2.70	34.7	2.7001
600	7.500	34.240	2.24	29.4	2.7771
650	6.899	34.280	1.86	23.1	2.8441
700	6.432	34.311	1.68	16.8	2.9189
750	5.879	34.320	1.60	10.9	1.9762
800	5.040	34.341	1.51	9.0	2.0294
850	4.975	34.350	1.56	8.6	2.0773
900	4.722	34.411	1.59	8.2	2.1244
950	4.434	34.441	1.64	7.6	2.1692
1000	4.203	34.477	1.74	7.1	2.2103

Station C7					Depth 5570m					Station C9					Depth 5550m					
Date	Sep. 23 1986	Depth	5570m		Date	Sep. 23 1986	Depth	5570m		Date	Sep. 23 1986	Depth	5550m		Date	Sep. 23 1986	Depth	5550m		
TIME	00:00	Lat.	19-04.3 N		TIME	04:00	Lat.	19-01.3 N		TIME	05:51	Lat.	18-59.3 N		TIME	05:51	Lat.	18-59.3 N		
D	T	S	D.O.	Dst	D	T	S	D.O.	Dst	D	T	S	D.O.	Dst	D	T	S	D.O.	Dst	
m	C		m/l	c/l/t	m	C		m/l	c/l/t	m	C		m/l	c/l/t	m	C		m/l	c/l/t	
0	28.495	34.640	3.81	584.6	0.0000	0	28.264	34.596	4.38	580.5	0.0000	0	28.159	34.590	4.37	578.9	0.0000	0	28.055	34.585
10	28.505	34.642	3.84	584.8	0.0610	10	28.258	34.594	4.42	580.5	0.0613	10	28.206	34.590	4.29	579.1	0.0585	10	28.153	34.584
20	28.280	34.617	3.85	579.7	0.1187	20	28.116	34.587	4.35	576.5	0.1166	20	28.158	34.582	4.24	578.0	0.1174	20	28.054	34.582
30	28.276	34.626	3.79	576.8	0.1770	30	28.078	34.588	4.36	575.3	0.1754	30	28.054	34.582	4.16	575.0	0.1742	30	28.040	34.589
50	28.230	34.615	3.77	578.0	0.2923	50	28.059	34.585	4.45	574.9	0.2916	50	28.040	34.589	4.30	574.0	0.2910	50	28.040	34.589
75	26.446	34.855	3.74	506.0	0.4279	75	25.932	34.926	4.31	485.5	0.4239	75	25.651	34.904	4.35	478.7	0.4227	75	25.651	34.904
100	25.140	35.002	3.55	456.7	0.5493	100	24.058	35.006	3.96	425.3	0.5382	100	23.624	34.979	3.89	415.0	0.5347	100	23.624	34.979
125	23.360	35.003	3.37	406.0	0.6568	125	22.623	35.013	3.84	385.0	0.6406	125	22.223	35.004	3.66	374.8	0.6359	125	22.223	35.004
150	22.070	35.003	3.27	370.8	0.7560	150	20.770	34.948	3.80	340.7	0.7323	150	21.167	34.967	3.62	349.6	0.7262	150	21.167	34.967
175	20.734	34.944	3.27	340.0	0.8474	175	19.892	34.930	3.75	319.7	0.8162	175	19.724	34.908	3.68	317.0	0.8125	175	19.724	34.908
200	19.300	34.911	3.25	306.6	0.9301	200	18.862	34.884	3.72	297.2	0.8958	200	18.613	34.882	3.61	294.9	0.8907	200	18.613	34.882
250	17.572	34.834	3.29	270.9	1.0788	250	17.120	34.808	3.77	262.5	1.0384	250	16.858	34.786	3.65	258.2	1.0318	250	16.858	34.786
350	14.202	34.582	3.28	218.2	1.3323	350	14.076	34.571	3.67	214.8	1.2866	350	14.083	34.571	3.57	215.0	1.2753	350	14.083	34.571
400	12.526	34.445	3.09	194.2	1.4995	400	12.270	34.429	3.49	190.7	1.3922	400	11.952	34.412	3.33	186.2	1.3813	400	11.952	34.412
450	11.000	34.342	2.96	174.7	1.5365	450	10.937	34.338	3.28	173.9	1.4880	450	10.926	34.341	3.23	173.5	1.4760	450	10.926	34.341
500	9.272	34.253	2.70	155.2	1.6237	500	9.445	34.262	3.04	155.2	1.5757	500	9.368	34.265	3.02	153.8	1.5624	500	9.368	34.265
550	8.210	34.235	2.32	130.8	1.7011	550	8.365	34.239	2.62	140.6	1.6545	550	8.293	34.232	2.59	140.2	1.6410	550	8.293	34.232
600	7.174	34.238	1.93	124.3	1.7725	600	7.334	34.236	2.17	126.5	1.7260	600	7.476	34.240	2.16	128.2	1.7130	600	7.476	34.240
650	6.522	34.304	1.63	110.9	1.6852	650	6.773	34.289	1.81	115.2	1.7912	650	6.786	34.286	1.78	114.9	1.7787	650	6.786	34.286
700	5.672	34.291	1.56	104.6	1.6931	700	6.003	34.306	1.62	104.4	1.8505	700	5.973	34.318	1.60	103.2	1.8376	700	5.973	34.318
750	5.208	34.339	1.50	92.7	1.9453	750	5.348	34.304	1.54	96.9	1.9052	750	5.227	34.298	1.51	96.0	1.8947	750	5.227	34.298
900	4.816	34.404	1.52	83.5	1.9942	800	5.091	34.382	1.54	88.2	1.9558	800	5.047	34.381	1.53	87.8	1.9445	800	5.047	34.381
850	4.506	34.494	1.63	78.9	2.0390	850	4.696	34.422	1.56	80.3	2.0026	850	4.664	34.418	1.55	80.9	1.9885	850	4.664	34.418
900	4.316	34.492	1.70	74.0	2.0814	900	4.421	34.457	1.66	75.5	2.0463	900	4.370	34.459	1.65	74.8	2.0315	900	4.370	34.459
950	4.154	34.514	1.87	68.4	2.1211	950	4.168	34.488	1.71	70.5	2.0870	950	4.200	34.511	1.81	69.4	2.0719	950	4.200	34.511
1000	3.853	34.524	1.94	64.7	2.1586	995	3.945	34.526	1.98	65.5	2.1247	995	3.961	34.516	1.90	66.3	2.1062	995	3.961	34.516

Station C7	Depth 5570m	Station C9	Depth 5550m
Date	Sep. 23 1986	Date	Sep. 23 1986
TIME	00:00	TIME	04:00
500	9.272	34.253	2.70
550	8.210	34.235	2.32
600	7.174	34.238	1.93
650	6.522	34.304	1.63
700	5.672	34.291	1.56
750	5.208	34.339	1.50
900	4.816	34.404	1.52
850	4.506	34.494	1.63
900	4.316	34.492	1.70
950	4.154	34.514	1.87
1000	3.853	34.524	1.94

Station C10				Depth 5480m				Depth 5530m				Depth 5500m					
Date	Sep. 23 1986	Lat.	19-57.4 N	Date	Sep. 23 1986	Lat.	19-00.4 N	Date	Sep. 24 1986	Lat.	18-55.3 N	Date	Sep. 24 1986	Lat.	18-55.3 N		
TIME	06:35	Long.	123-26.0 E	TIME	08:00	Long.	123-25.6 E	TIME	06:05	Long.	123-09.9 E	TIME	06:05	Long.	123-09.9 E		
D	T	S	D.O.	Dst	Del-D	D	T	S	D.O.	Dst	Del-D	D	T	S	Dst	Del-D	
m	C	m/l/1	c/l/t	m	c	m	C	m/l/1	c	m/l/1	c/l/t	m	C	m/l/1	c	m/l/1	
0	28.160	34.550	4.18	577.7	0.0000	0	28.359	34.641	3.83	580.3	0.0000	0	28.346	34.584	4.70	584.0	0.0000
10	28.115	34.569	4.09	577.9	0.0582	10	28.353	34.638	3.88	580.3	0.0604	10	28.349	34.584	4.48	584.0	0.0605
20	28.146	34.562	4.00	577.9	0.1167	20	28.339	34.639	3.88	578.8	0.1178	20	28.350	34.584	4.33	584.1	0.1168
30	28.027	34.568	4.03	575.1	0.1739	30	28.272	34.627	3.73	578.6	0.1743	30	28.413	34.571	4.33	577.6	0.1758
50	28.013	34.572	4.01	574.4	0.2806	50	28.254	34.631	3.77	577.7	0.2914	50	28.042	34.588	4.25	574.2	0.2824
75	25.926	34.947	4.08	471.9	0.4208	75	26.575	34.848	3.78	510.3	0.4282	75	25.510	34.959	4.45	470.6	0.4233
100	23.774	35.020	3.68	416.3	0.5345	100	24.504	34.905	3.80	445.3	0.5474	100	23.939	35.034	4.07	419.9	0.5361
125	22.362	34.988	3.48	379.7	0.6345	125	23.230	35.022	3.50	401.0	0.6564	125	23.214	35.016	3.93	400.9	0.6443
150	20.906	34.975	3.39	344.5	0.7255	150	21.822	34.991	3.40	365.1	0.7528	150	21.937	34.968	3.80	369.8	0.7390
175	19.715	34.912	3.43	316.6	0.8105	175	20.287	34.934	3.35	329.4	0.8410	175	20.851	34.956	3.88	342.2	0.8270
200	18.638	34.882	3.39	292.5	0.8884	200	19.127	34.894	3.30	363.4	0.9216	200	19.709	34.919	3.86	315.9	0.9148
250	17.159	34.811	3.42	265.1	1.0505	250	17.291	34.817	3.37	285.7	1.0692	250	17.154	34.812	3.72	263.0	1.0607
350	14.110	34.560	3.39	214.9	1.2792	350	14.567	34.616	3.43	221.5	1.3200	350	13.513	34.526	3.48	207.0	1.3039
400	12.300	34.433	3.21	192.6	1.3645	400	12.143	34.445	3.48	189.4	1.4273	400	11.338	34.355	3.24	178.5	1.4053
450	11.157	34.357	3.05	176.2	1.4620	450	10.987	34.341	3.03	174.7	1.5236	450	9.938	34.288	3.00	161.0	1.4945
500	9.816	34.264	2.95	161.1	1.5714	500	9.285	34.246	2.81	154.0	1.6112	500	8.576	34.230	2.61	144.4	1.5763
550	8.255	34.237	2.40	139.3	1.0513	550	8.004	34.242	2.26	135.2	1.5874	550	7.425	34.244	2.45	127.2	1.6481
600	7.354	34.233	2.04	127.0	1.7235	600	7.070	34.238	1.91	122.9	1.7574	600	6.688	34.271	1.74	115.5	1.7124
650	6.579	34.267	1.68	112.9	1.7070	650	6.227	34.295	1.58	107.9	1.8191	650	5.885	34.234	1.68	108.4	1.7734
700	5.958	34.321	1.51	102.8	1.8459	700	5.534	34.303	1.46	99.1	1.8753	700	5.530	34.336	1.53	96.6	1.8233
750	5.130	34.301	1.45	94.7	1.9000	750	5.224	34.330	1.42	93.6	1.9274	750	5.233	34.371	1.51	90.6	1.8798
800	5.036	34.380	1.44	87.7	1.9490	800	4.948	34.396	1.46	85.6	1.9767	800	4.985	34.398	1.54	85.8	1.9281
850	4.656	34.420	1.49	80.7	1.9964	850	4.550	34.441	1.50	77.9	2.0245	850	4.599	34.437	1.58	78.8	1.9734
900	4.354	34.462	1.57	74.4	2.0396	900	4.280	34.464	1.58	73.5	2.0638	900	4.341	34.467	1.75	73.9	2.0162
950	4.174	34.504	1.66	69.4	2.0793	950	4.200	34.511	1.74	69.1	2.1036	950	3.979	34.488	1.70	68.6	2.0561
995	3.910	34.518	1.82	66.1	2.1137	1000	3.919	34.522	1.86	65.5	2.1422	1000	3.750	34.510	1.76	64.8	2.0934

Station C10	Depth 5480m	Depth 5530m	Depth 5500m
Date	Sep. 23 1986	Lat.	19-57.4 N
TIME	06:35	Long.	123-26.0 E
0	28.160	34.550	4.18
10	28.115	34.569	4.09
20	28.146	34.562	4.00
30	28.027	34.568	4.03
50	28.013	34.572	4.01
75	25.926	34.947	4.08
100	23.774	35.020	3.68
125	22.362	34.988	3.48
150	20.906	34.975	3.39
175	19.715	34.912	3.43
200	18.638	34.882	3.39
250	17.159	34.811	3.42
350	14.110	34.560	3.39
400	12.300	34.433	3.21
450	11.157	34.357	3.05
500	9.816	34.264	2.95
550	8.255	34.237	2.40
600	7.354	34.233	2.04
650	6.579	34.267	1.68
700	5.958	34.321	1.51
750	5.130	34.301	1.45
800	5.036	34.380	1.44
850	4.656	34.420	1.49
900	4.354	34.462	1.57
950	4.174	34.504	1.66
995	3.910	34.518	1.82

Station	D	Depth	S180m
Date	Sep. 25 1986	at.	20°19'.1 N
TIME	02:23	Long.	125°55'.5 E
D	T	S	O.O.
m	g	ml/l	c/l/t
0	27.359	34.565	4.54
10	27.351	34.668	4.47
20	26.683	34.682	4.66
30	26.335	34.700	4.69
50	26.159	34.711	4.43
75	25.572	34.753	4.39
100	22.836	34.858	4.14
125	20.096	34.927	3.80
150	19.822	34.905	3.81
175	18.086	34.876	3.82
200	17.989	34.854	3.78
250	16.718	34.785	3.82
350	14.202	34.592	3.76
400	13.037	34.498	3.65
450	11.649	34.380	3.48
500	10.267	34.306	3.21
550	8.414	34.207	2.94
600	7.381	34.191	2.59
650	6.804	34.254	2.27
700	6.004	34.247	1.99
750	5.711	34.284	1.90
800	4.925	34.268	1.64
850	4.460	34.355	1.50
900	4.296	34.370	1.47
950	4.025	34.409	1.49
1000	4.009	34.456	1.60

