Preliminary Report
of
The Hakuho Maru Cruise KH-98-2

May 22, 1998 - July 2, 1998
(Eel Cruise VIII)

EEL CRUISE VIII OCEAN RESEARCH INSTITUTE
JAGO & HAKUHO MARU MAY - JULY 1998

Ocean Research Institute
The University of Tokyo
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By
The Scientific Members of the Expedition

Edited by
Tadashi Inagaki and Katsumi Tsukamoto

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V. Leg.2

Ⅰ. Preface

The scientific mission of the HAKUHO-MARU Cruise KH-98-2 was terminated by the deployment of two Argus buoys west of Ogasawara Islands at 03:00 a.m. in complete darkness. While passing the impressive pinnacle of Sohu-Gan Island on the way back to Tokyo, all scientific members of the cruise were busy preparing their cruise reports. A total of 50 scientists and students of different scientific disciplines participated in this cruise, which is coming to an end after 42 days at sea.

The Cruise KH-98-2 had two main aims: (1) the investigation of the community of deep sea bacteria in the Western Pacific and (2) the ecology, migration and spawning behaviour of the Japanese eel *Anguilla japonica*.

The main target of the first leg (22 May - 02 June 1998) was the microbiology of the deep sea. On the way from Tokyo to Guam we conducted CTD-NISKIN and NISKIN-Butterfly sampling as well as sampling of ocean floor sediment using the multiple corer at 8 stations (12 observations) between the Izu-Ogasawara and the Mariana Trench. The most impressive event of the leg was the sampling of ocean floor sediment at almost 10500 meters depth - the deepest point of the world's oceans. We are confident to gain new information about the community of deep sea bacteria and their adaptation mechanisms to a life in cold water and at high pressure. Beside bacteria sampling we conducted net sampling with the ORI plankton net and the IKMT net. For the first time, a member of a social science faculty joined our cruise; Professor T. Tamura gave an interesting and motivating talk at the Seminar at Sea about his main research subject aboard- the Oceans in Literature.

The main target of the second leg (08 June to 02 July) was the survey for the spawning grounds of the Japanese eel at two sea mounts of the Western Mariana Ridge, Arakane and Pathfinder Reef. Five German scientists of the Max-Planck-Institute of Animal Behaviour and Physiology participated with their manned submersible "JAGO" (maximum diving depth 400 m). We performed 27 dives between 20 and 400 m depth to search for spawning aggregations of eels around the two sea mounts. During the intensive surveys (in total 91 hours) along the steep slopes of both sea mounts not a single adult eel was encountered. We conclude that adult eels do not aggregate for spawning at sea mounts in water depths shallower than 400 m at this time of the year.

Beside the search for adult eels by submersible we performed IKMT net sampling around both sea mounts. In total, 24 *A. japonica* leptocephali and 237 anguilliformes eggs were collected. The morphological and molecular analyses of the eggs will be made for final species identification. In order to get hints for the migration and spawning depths of adult eels we performed telemetry experiments. Five pre-matured eels were tagged with pressure sensing ultrasonic transmitters and released from board of the submersible close to the slope of the sea mounts. Tracking was performed in rough sea conditions with a small inflatable and it was not easy to keep close distance to a moving fish in open water. We successfully tracked four out of five tagged eels, the last one even for a total duration of 7 hours. The eels left the slope of the sea mount and moved into open water, maintaining a swimming depths of 100-200 m which might give hints for the migration depths of adult eels. Furthermore, we monitored the behaviour of sharks with a video camera stationed at the reef, and also caught sharks to investigate their stomach content because large numbers of sharks were previously observed at the edges of the sea mounts and they might be predators of adult eels aggregating at the reef.

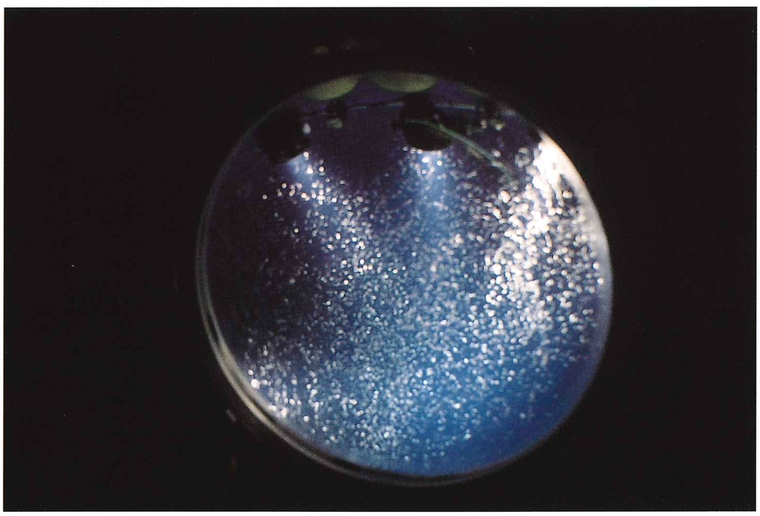
Scientists of four different nations took part in the second leg which gave the cruise an international atmosphere. The official language used during meetings and at the Seminar at Sea was English. Communication was therefore sometimes a bit difficult but never affected the scientific routine work - there was always a general understanding among all cruise members and a very enjoyable atmosphere.

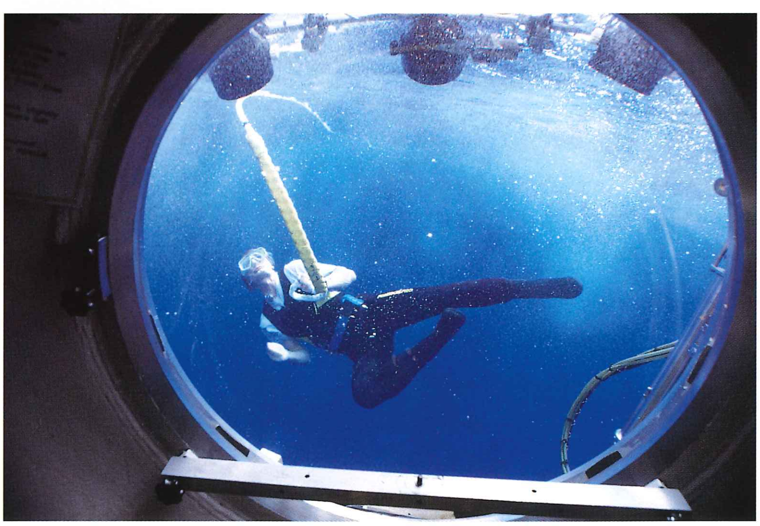
There was no time loss caused by bad weather during the entire cruise. The Captain Y. Tanaka and his crew of the R/V HAKUHO-MARU did their best to make all parts of the cruise successful. It was the first time that a manned submersible was operated from board of the vessel. The handling of the delicate vehicle was performed in a very safe and professional way - there was never a crucial moment during the handling procedure. On behalf of all scientists on board and of the JAGO-Team I would like to thank the Captain and his crew for all their efforts during this special cruise.

Director' s cabin, 30 June 1998

K. Tsukamoto

Katsumi Tsukamoto





Ⅱ. Outline of the cruise

Tadashi Inagaki, Hiroshi Hasumoto and Machiko Oya

The cruise consisted of two legs: leg. 1 from 22 May (Tokyo) to 2 June (Guam); leg.2 from 8 June (Guam) to 2 July 1998. R/V Hakuho Maru was ported at the Napra Harbor, Guam, for 5 days between two legs.

Under the overall objective of "Marine biological investigation on the spawning and migration of the Japanese eel and microbial community around the Mariana Islands", the following research items were investigated:(1) Observation of spawning behavior of wild adult eel by a research submersible, (2) Determination of spawning depth of freshwater eel by releasing of artificially matured fish with telemetric pinger, (3) Egg sampling by a IKMT plankton net, (4) Measurement of environmental conditions for eel spawning by CTDO, (5) Study on marine microbial community by sampling water and soft sediment.

In leg.1, marine microbial research was conducted mainly in the Subtropical Countercurrent and the North Equatorial Current along 142°E and at the Mariana trench using CTDO, Niskin Butterfly, Multi-core sampler. And, net samplings for micronecton and zooplankton were carried out along 142°E line using IKPT, VMPS and ORI. For current monitoring in the North Equatorial Current, 8 ARGOS buoys were released near seamounts located south end of Mariana ridge.

In leg.2, observation of spawning behavior of wild adult eel by a research submersible (JAGO) and egg sampling by a IKPT net were conducted near/on seamounts, Arakane and Pathfinder. And bio-telemetry of artificially matured eel was carried out on the seamount.

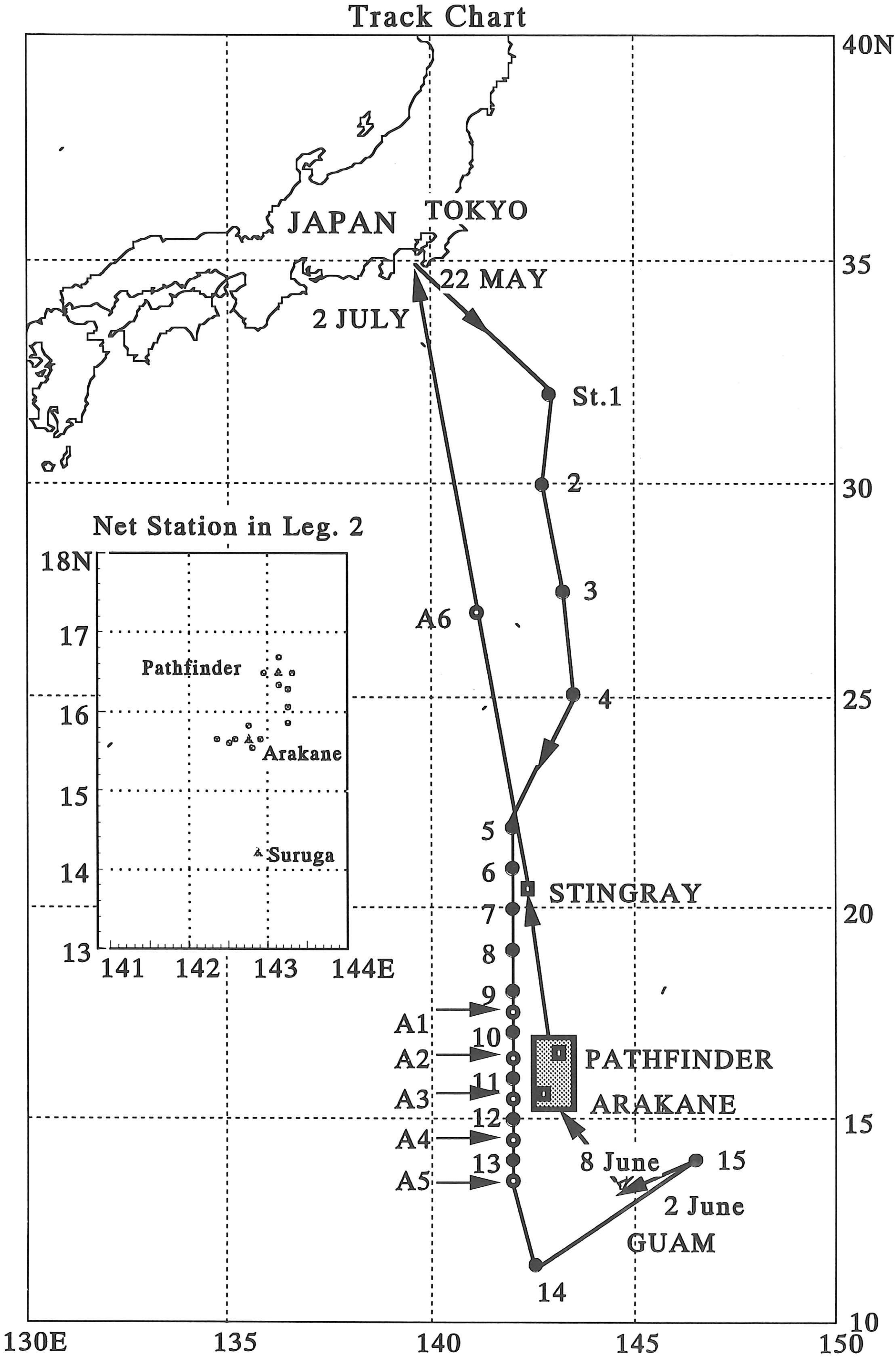
The location of observation sites and track chart are shown in Fig.1.and log sheets(see last section). Scientists aboard was listed in Table 1. This team consisted of six foreign biologist from German and Korea and 44 Japanese scientists.

Table 1 Scientists aboard

◎	TSUKAMOTO Katsumi	*1	KIMURA Yobuo	*1
○	OHWADA Kouichi	*1	MIYAI Takeshi	*1
○	FRICKE Hans	*13	TOYODA Keita	*1
	NISHIDA Shuhei	*1	FUJII Koji	*1
	KUBOKAWA Kaoru	*1	NAGATA Mac	*1
	NISHIMUR Masahiko	*1	UTO Tomoko	*1
	WADA Minoru	*1	AIDA Katsumi	*2
	HASUMOTO Hiroshi	*1	SUZUKI Yuzuru	*2
	INAGAKI Tadashi	*1	TAMURA Takeshi	*3
	SAKIYAMA Tokuki	*1	UEDA Hiroshi	*4
	OYA Machiko	*1	LOKMAN P. Mark	*5
	ISHIKAWA Satoshi	*1	OTAKE Tsuguo	*6
	AOYAMA Jun	*1	FUKAMI Kimio	*7
	URAKAWA Hidetoshi	*1	AKIZAWA Kaori	*7
	WATANABE Shun	*1	MOCHIOKA Noritaka	*8
	YOSHINAGA Tatsuki	*1	TORII Akihisa	*9
	SASAI Seiji	*1	KATAYAMA Hironori	*9
	INOUE Jun	*1	KAWAGUCHI Akira	*10
	INOUE Takashi	*1	MIYA Masaki	*11
	KIMATA Noriko	*1	OHSHIMO Seiji	*12
	RADJASA Ocky Karna	*1	HISSMANN Karen	*13
	SHINODA Akira	*1	SCHAUER Juergen	*13
	YOSHIDA Tsutomu	*1	KOHLER Uwe	*13
	KURATA Yasuharu	*1	HASSENPFLUG Gustav	*13
	MATSUURA Hiroyuki	*1	LEE Tae Won	*14

*1 Ocean Research Institute, The University of Tokyo
*2 Dep. Aqua. Biosci.,Grad. Sch. of Agr. and Life Sci.,The Univ. of Tokyo
*3 Dep. French langu. and literature, Faculty of Letters, The Univ. of Tokyo
*4 Toya Lake Station for Enviro. Biol.,Faculty of Fish.,Hokkaido Univ.
*5 Department of Biology, Faculty of Fisheries, Hokkaido University
*6 Department of Bioresources,Mie University
*7 Laboratory of Aquatic Environmental Science , Kochi University
*8 Department of Fisheries,Faculty of Agriculture,Kyushu University
*9 Faculty of fisheries,Kagoshima University
*10 Faculty of Bioresources, Fukui Prefectual University.
*11 Department of Zoology,Natural History Museum & Institute, Chiba
*12 Resource Management Division,Seikai Nat. Fish. Res.Inst.
*13 Max-Planck-Inst. of Animal Behaviour and Physiology,JAGO-Team
*14 Department of Oceanography,Chungnam National University

◎Chief Scientist(Director of this cruise)
○Vice director



Track Chart
40N
35
30
25
20
15
10
130E
135
140
145
150
JAPAN
TOKYO
22 MAY
2 JULY
St.1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
A1
A2
A3
A4
A5
A6
STINGRAY
PATHFINDER
ARAKANE
8 June
2 June
GUAM
Net Station in Leg. 2
18N
17
16
15
14
13
141
142
143
144E
Pathfinder
Arakane
Suruga

Ⅲ.Hydrographic measurements of KH-98-2 Cruise

Tadashi Inagaki, Hiroshi Hasumoto and Takashi Inoue

During the expedition of the research vessel Hakuho Maru of Ocean Research Institute, hydrographic observations consisting of conductivity, temperature and depth measurements were carried out at 18 stations to use CTDO(Sea-Bird's 911 plus) in the Subtropical Countercurrent and the North Equatorial Current along 142° E(142° E - 144° E). During the first leg, CTDO operation was conducted at 4 stations(St.1,2,3 and 4) in about 2.5° latitude interval from 32° N to 25° N and was conducted at 8 stations(St. 7,8,9,10,11,12,13 and A5) in 1° latitude interval from 20° N to 13.5° N(See track chart). And 2 CTDO operations were carried out at Mariana Trench (St.14 and 15)(See track chart). During the second leg, 4 CTDO operations were carried out near the Seamounts. The original data is summarized in table as appendix and measured maximum depth is shown in Table 1. And, vertical profiles of temperature and salinity from 13.5° N to 32.0° N along 142° E in first leg are shown in Fig.1.

Table. 1 Maximum depth of CTDO at each station.

Station	Max. depth(m)	Station	Max. depth(m)	Station	Max. depth(m)
1	1011	2	6408	3	6205
4	4015	5	1024	7	1000
8	1026	9	1011	10	1002
11	1014	12	4000	13	1010
A5	1011	14	6822	15	6812
CTD1	1016	CTD2	823	CTD3	816
CTD4	1014				

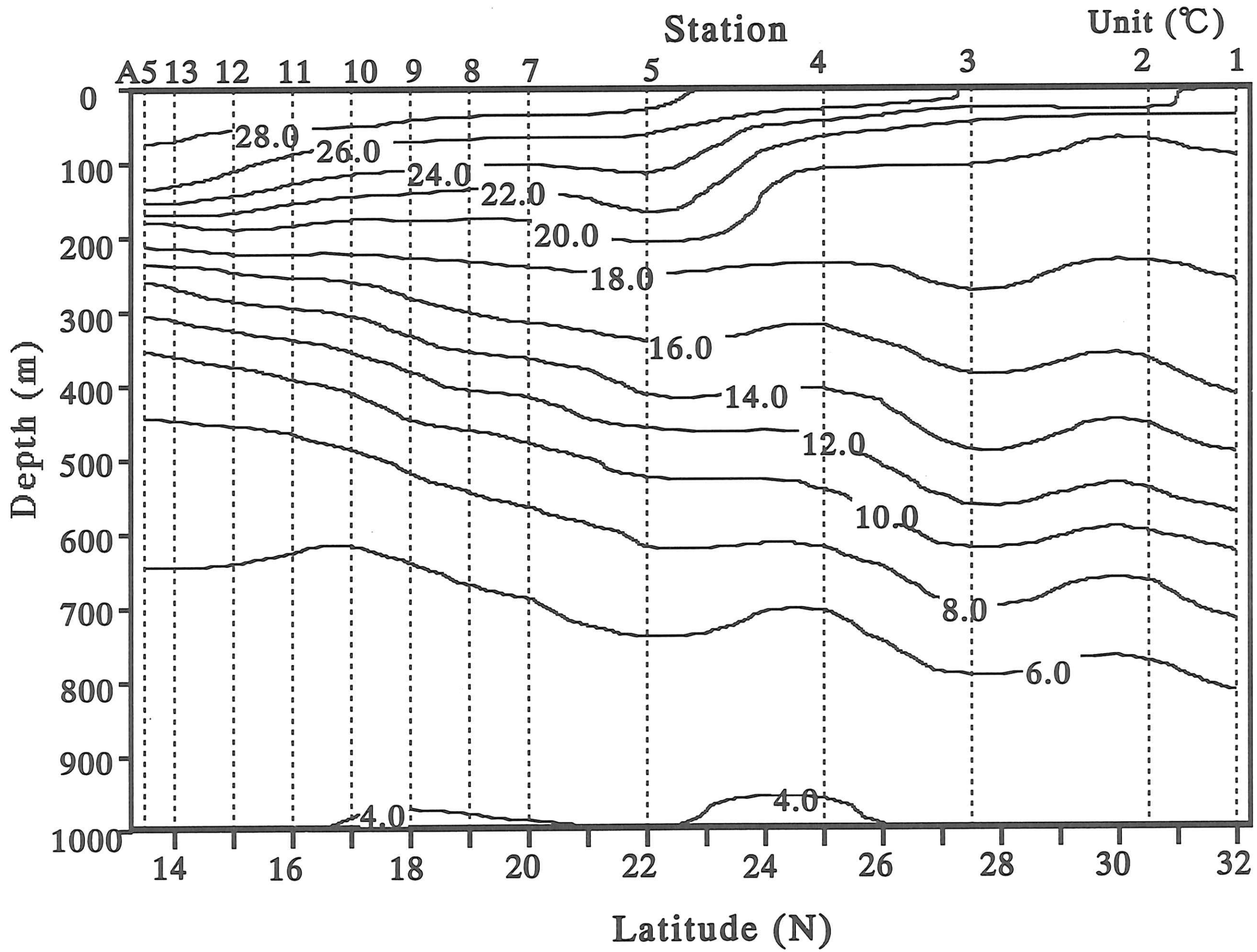


Fig.1. Temperature along 142° E

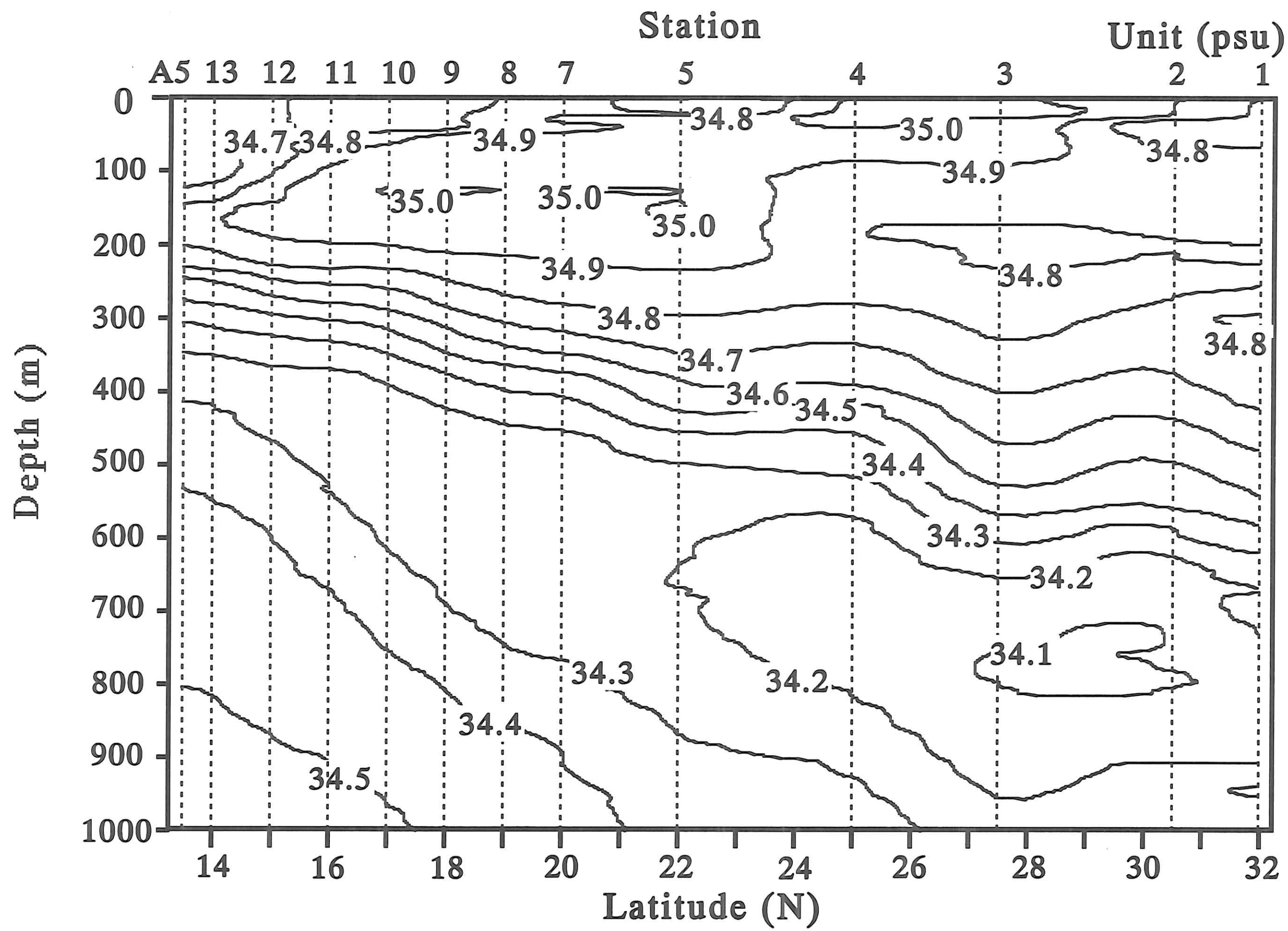


Fig.1. Salinity along 142° E

Ⅳ. Leg. 1
Studies on marine microbial communities

Kouichi Ohwada, Masahiko Nishimura, Minoru Wada,
Hidetoshi Urakawa, Okey K. Radjasa, Noriko Kimata,
Tsutomu Yoshida and Keita Toyoda

Following microbiological studies have been conducted with the seawater and sediment samples. Seawater samples were taken aseptically with Niskin Butterfly samplers from different depths at St.2, St.3, St.4, St.5, St.12, St.14 and St.15. Sediment samples were taken using Multiple Core at St.2, St.3, St.14, St.15.

1) Direct count and viable count of marine bacteria in seawater.

Direct count: Microorganisms in the seawater samples were concentrated on Nuclepore filter (pore size 0.2 micrometers), stained with DAPI solution, and counted under fluorescent microscope (Fig.1).

Viable count: Microorganisms in the seawater samples were concentrated on Nuclepore filter (pore size 0.2 micrometers), and incubated on 1/5 ZoBell 2216E agar plates at 4℃ and 18℃ (Fig.2).

2)Isolation of barophilic bacteria from the deep-sea sediment samples.

For the isolation of barophilic bacteria from the deep-sea sediment samples at St.14 and St.15, samples were inoculated to 1/5 ZoBell 2216E liquid medium, and incubated at 4℃ under pressure almost same levels where each sample was taken. Physiological and taxonomic studies have been undertaken for the isolated barophilic cultures.

3) Isolation of psychrotrophic and psychrophilic bacteria in seawater from different depths.

Both agar plate culture and liquid culture at 4℃ were used for the isolation of psychrotrophic and psychrophilic bacteria in water columns. these cultures have been used for the charecteriization of temperature adaptation and taxonomic studies.

4) Analysis of microbial communities in deep-sea sediments.

Quinon fractions are now used as good biomakers of microbial community. Sediment samples were sliced with 2 cm intervals and kept -80℃. These samples have been used to analyze quinon profiles after extraction of quinon fractions from microorganisms in the sediment samples and characterize the fraction with HPCL.

Table 1. Direct count of marine bacteria.

Direct count(No./liter)

Depth(m)	St.2	St.3	St.4	St.5	St.12	St.14	St.15
0	-	$1.0x10^8$	$4.0x10^8$	$4.0x10^8$	$4.8x10^8$	$4.1x10^8$	$6.4x10^8$
2	$4.0x10^8$	$5.1x10^8$	$4.5x10^8$	$4.5x10^8$	-	$5.4x10^8$	$3.8x10^8$
50	$6.3x10^8$	$1.3x10^9$	$4.6x10^8$	$3.6x10^8$	$8.9x10^8$	$6.1x10^8$	$2.3x10^8$
75	$1.1x10^9$	$7.3x10^8$	$3.0x10^8$	$5.1x10^8$	$4.5x10^8$	$4.9x10^8$	$2.9x10^8$
100	-	$3.4x10^8$	$3.9x10^8$	$6.8x10^8$	$1.0x10^9$	$3.9x10^8$	$6.7x10^8$
150	-	$4.1x10^8$	$2.3x10^8$	$2.5x10^8$	$3.2x10^8$	-	$3.4x10^8$
200	$6.4x10^8$	$3.5x10^8$	$1.4x10^8$	$2.2x10^8$	$2.9x10^8$	$1.4x10^8$	$1.0x10^8$
500	$2.7x10^8$	$1.0x10^8$	$1.4x10^8$	$9.7x10^7$	$1.2x10^8$	-	-
1000	$2.4x10^8$	$3.1x10^7$	$8.9x10^7$	$4.7x10^7$	$4.8x10^7$	$4.4x10^7$	$6.1x10^7$
2000	$8.5x10^7$	$4.1x10^7$	$5.0x10^7$	-	$3.9x10^7$	$3.8x10^7$	$6.2x10^7$
3000	$2.0x10^8$	$3.4x10^7$	$7.6x10^7$	-	$6.7x10^7$	-	$5.2x10^7$
4000	$4.3x10^7$	$3.8x10^7$	$5.6x10^7$	-	$5.0x10^7$	$2.0x10^7$	$8.0x10^7$
5000	$4.6x10^7$	$3.9x10^7$	-	-	-	$2.1x10^7$	$1.8x10^7$
8000	$7.0x10^7$	$7.0x10^7$	-	-	-	$3.1x10^7$	(6800m)
9000	(6000m)	(6000m)				$4.4x10^7$	
10000						$4.1x10^7$	

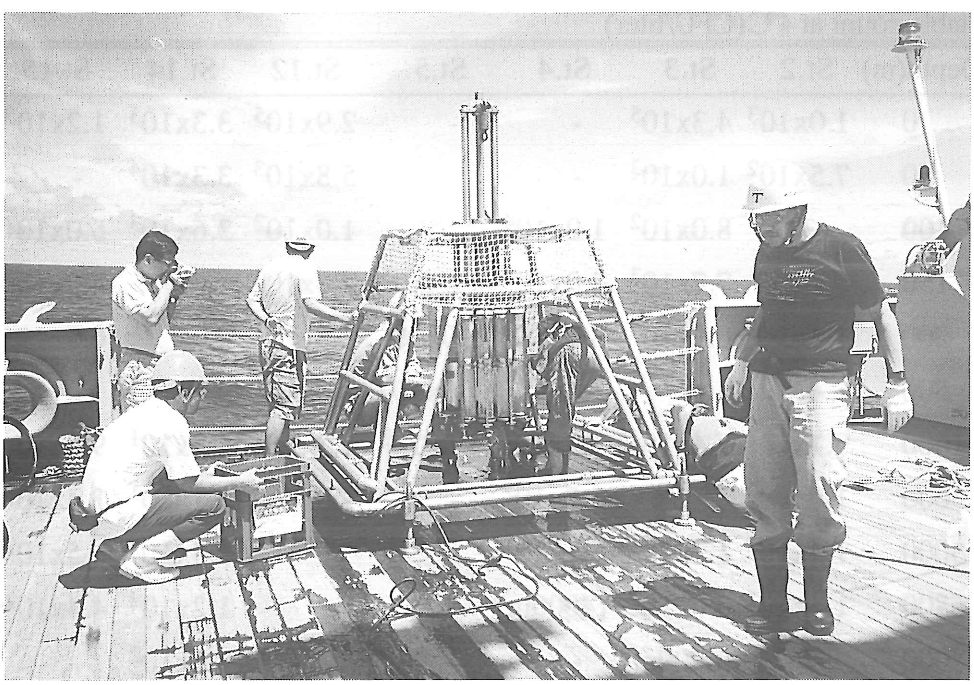
Table 2. Viable count of marine bacteria.

Viable count at 18℃(CFU/liter)

Depth(m)	St.2	St.3	St.4	St.5	St.12	St.14	St.15
0	$2.3x10^4$	$5.8x10^4$	-	-	$6.4x10^5$	$6.4x10^5$	$2.1x10^5$
50	$5.7x10^3$	$1.1x10^4$	-		$1.8x10^5$	$3.3x10^5$	$1.1x10^4$
100	-	$1.9x10^3$	$6.2x10^4$	-	$2.0x10^3$	$3.8x10^3$	$7.8x10^3$
150	-	$1.4x10^4$	$1.5x10^3$	$2.5x10^4$	$4.1x10^3$	-	$1.7x10^3$
200	$2.3x10^3$	$1.1x10^4$	$1.7x10^4$	$2.0x10^3$	$2.6x10^3$	$7.5x10^4$	$2.5x10^3$
500	-	-	$1.5x10^3$	$1.0x10^3$	$1.0x10^3$	-	-
1000	$1.8x10^3$	$2.1x10^3$	$5.2x10^3$	$2.4x10^3$	$1.9x10^2$	$2.5x10^2$	$2.5x10^4$
3000	$2.5x10^2$	$1.4x10^3$	$1.0x10^3$	-	$2.1x10^3$	$3.4x10^2$	$5.9x10^2$
5000	$2.7x10^3$	$6.3x10^2$	$1.6x10^3$	-	-	$4.2x10^2$	$3.3x10^3$
6800	$5.3x10^1$	$1.8x10^3$	(4000m)	-	-	$1.2x10^3$	$3.7x10^3$
8000	-	(6200m)	-	-	-	$4.1x10^3$	-

Viable count at 4℃(CFU/liter)

Depth(m)	St.2	St.3	St.4	St.5	St.12	St.14	St.15
0	$1.0x10^3$	$4.3x10^5$	-	-	$2.9x10^5$	$3.3x10^5$	$1.2x10^5$
50	$7.5x10^2$	$1.0x10^3$	-		$5.8x10^3$	$3.3x10^4$	-
100	-	$8.0x10^2$	$1.0x10^4$	-	$1.0x10^2$	$3.6x10^3$	$5.0x10^2$
150	-	$7.7x10^3$	$3.0x10^2$	$1.6x10^3$	$7.0x10^2$	-	$4.0x10^2$
200	$1.4x10^3$	$8.0x10^2$	$3.2x10^3$	$5.0x10^2$	$5.3x10^1$	-	$6.5x10^2$
500	-	-	$5.6x10^2$	$7.0x10^2$	$2.0x10^1$	-	-
1000	$9.1x10^2$	$7.4x10^2$	$3.3x10^2$	$1.6x10^3$	$1.3x10^2$	$4.0x10^1$	$9.7x10^2$
3000	$1.0x10^2$	-	$5.7x10^2$	-	$1.5x10^3$	$5.1x10^1$	$3.4x10^2$
5000	$7.4x10^2$	$1.2x10^2$	$5.1x10^1$	-	-	$2.0x10^1$	$4.5x10^2$
6800	$1.5x10^1$	$6.0x10^1$	(4000m)	-	-	$1.2x10^2$	$4.4x10^2$
8000	-	(6200m)	-	-	-	$4.8x10^2$	-



Habitat adaptation of bacterial communities in surface and deep sea waters

Kimio Fumami and Kaori Akizawa

Introduction

Diverse communities of microorganisms inhabit various, physically and chemically different, environments in the ocean. When we consider the water column vertically in particular, living habitats of microbes change significantly from surface to deep-sea waters in terms of temperature, light conditions, and hydrostatic pressure. In addition to the above factors, there distribute abundant fresh organics produced by phytoplankton in the surface water, while in the deep-sea water most of organic matter would be refractory. Therefore, amount and the chemical composition of organic matter are quite different between surface and deep-sea waters. These facts introduce us to speculate that the community structure of bacteria in seawater would be different between the two depths. However, there is only few information on whether surface and deep-sea waters are inhabited by fundamentally different bacterial communities (segregation) or they adapt in each environments (adaptation).

In the cruise of KH-98-2, we inoculated bacterial communities of both surface and deep-sea waters into either of the two depth waters and incubated under two temperatures and two hydrostatic pressures. Changes in bacterial abundances were, then, measured for evaluating the effect of these parameters on the growth of bacteria. Our final purpose is to elucidate whether the bacterial communities in surface and deep-sea waters adapted or segregated in each habitats.

Materials and Methods

Water samples were collected from 50 and 5000 m depths at the Stns. 2 (30° 01.30N, 14° 51.93E) and 3 (27° 30N, 143° 20E) by CTD-RMS. Seawaters in Niskin bottles of the two depths were filter-sterilized through 0.22 Sterivex filtering unit and seawaters for incubation ("seawater") were prepared. On the other hand, bacteria-inoculating samples ("bacteria") were collected aseptically by using a Niskin-butterfly sampler. Ten ml of the "bacteria" samples collected from either of 50 or 5000m depths was inoculated into 500 ml of "seawater"s of either 50 or 5000 m. Then, we prepared 4 systems as a combination of "seawater" and "bacteria" samples. A part of these 4 systems were put in the vinyl bags and incubated under pressure of 500 atms. We finally prepared the following 12 different incubating samples by the "seawater", "bacteria", temperature, and hydrostatic pressure (Table 1).

Table 1. Combinations for incubating seawater samples under 12 different condition

SEAWATER (m)	BACTERIA (m)	TEMPERATURE (℃)	PRESSURE (atm)
50	50	25	1
50	5000	5	1
5000	50	25	1
5000	5000	5	1
50	50	25	500
50	5000	20	500
5000	50	20	500
5000	5000	20	500
50	50	5	500
50	5000	5	500
5000	50	5	500
5000	5000	5	500

During the incubation period for 1 week, subsamples were with drawn from the bottles at regular time intervals, and the abundances of bacteria in the seawaters were counted by using an epifluorescence microscopy.

Results and Discussion

Bacterial abundances in seawaters of 50 and 5000 m depths at Stn.2 were 2.92×10^5 cells ml^{-1} and 3.42×10^4 (unit is the same; afterwards, too), respectively, and those at Stn. 3 were 3.46×10^5 and 2.27×10^4, respectively. These bacterial abundances are significantly low values, indicating that both stations were situated in extremely oligotrophic areas.

In Table 2 are shown changes in the bacterial abundances in 12 different incubating samples of Stns. 2 and 3. The incubating systems which showed highest final cell yields of bacterial abundances were those inoculated with surface bacteria to any of 50 or 5000 m seawater and incubated at 1 atm under 26℃. Bacterial abundances increased over 2×10^5 cells ml^{-1} after 1 week incubation period. When the bacteria of 5000 m depth were inoculated to 5000 m seawater and incubated at 5℃ under 1 atm, the increasing ratios of the maximum yields to the initial abundances were significantly high, although the values of final cell yields were not so large. The lowest increase of bacterial abundances was obtained in the incubation sample in which bacterial community of deep-sea water was inoculated to the surface water and incubated at 5℃ under 500 atm. These results suggest that bacterial communities in surface and deep-sea waters were quite different and would segregate in each environments. It showed that they could not adapt so easily to the new environmental conditions in a short period.

For evaluating the effect of hydrostatic pressure, final cell yields of bacteria were compared between under 1 and 500 atms within the same "seawater-bacteria" system. Results indicate that cell yield was always higher at 1 atm than 500 atm even the deep-sea bacteria were inoculated to the deep-sea water. This result suggests that the population of the barophilic bacteria did not predominate so much even in the bacterial community of deep-sea water, and that most bacteria have the preference of normal hydrostatic pressure.

Table 2. Change in bacterial abundances (xe5 cells/ml) during the incubation for each incubation conditions.

Seawater	5000m			5000m			50m			50m		
Bacteroa	5000m			50m			5000m			50m		
	1 atm. 5℃	Press. 5℃	Press. 20℃	1 atm. 26℃	Press. 5℃	Press. 20℃	1 atm. 5℃	Press. 5℃	Press. 20℃	1 atm. 26℃	Press. 5℃	Press. 20℃
Stn.2.												
0h	1.83	1.83	1.83	4.5	4.5	4.5	81.6	81.6	81.6	13.2	13.2	13.2
6h	21.3			23.1			219			37.3		
12h	3.87			4.79			84.2			14.4		
18h	24.5			26.7			190			17.3		
24h	4.04			11.2			95.5			20		
36h	3.99			36.6			148			125		
48h	4.19			42.6			104			255		
3d	4.26			153			159			175		
4d	3.86			75.8			137			126		
5d	50.1			163			214			187		
7d	29.5			148			174			240		
9d	34	20.1	27.1	197	30.9	32.7	234	25.3	157	277	18.1	35.5
Stn.3.												
0h	4.12	4.12	4.12	14.5	14.5	14.5	24.1	24.1	24.1	64.4	64.4	64.4
6h	73.5			24.9			54.9			113		
12h	5.69			9.59			21.2			64.5		
18h	44.1			53			56			109		
24h	5.77			12.5			29.1			80.5		
36h	48.3			93.9			24.7			140		
48h	8.72			135			39.3			101		
3d	59.3			131			39.1			163		
4d	52.9			169			30.7			195		
5d	72.2			196			83.5			288		
7d	77.8			245			56.3			240		
8d	110	8.65	10.1	234	16.9	40.9	83.6	33.4	131		61.8	218

Studies on ecology and functional morphology of some oceanic zooplankton

Hiroyuki Matsuura, Yasuharu Kurata and Shuhei Nishida

The following topics were investigated by using plankton samples collected in the subtropical western North Pacific with either an ORI net, an Isaacs-Kidd midwater trawl, or a Vertical multiple plankton sampler.

1. Structure of the parabolic eyes and digestive tract in the deep- sea copepods of the Genus *Cephalophanes* with reference to their food habit

The deep-sea copepods of the Genus *Cephalophanes* are characteristic in their large eyes with parabolic reflectors, but their ultrastructure and ecological significance have rarely been investigated. For a better understanding of their biology, we examined the structure of the eyes, digestive tract, and gut contents of *Cephalophanes* spp., collected from deep-waters (500-1000 m) of the subtropical western North Pacific, through light- and electron microscopic observations.

Immediately after collection, specimens of *Cephalophanes* spp. were sorted from the plankton samples and fixed in 2% glutaraldehyde and 2.5% paraformaldehyde (phosphate buffer, pH 7.4) at 4℃. They were then post-fixed in 1% OsO_4 and prepared for scanning (SEM) and transmission electron microscopy (TEM).

The optic system of *Cephalophanes refulgens* consists of a pair of large, bilateral parabolic reflectors each having anteriorly two dorso-ventrally arranged ocelli, as was described by previous workers. According to our observation, the reflector has a multilayer structure of thin (0.5-0.8μm) plates, presumably of a chitinous material; the number of plates is ca. 10-20 at the anterior margin of the reflector, increases posteriorly, and reaches ca. 80 near the summit of the parabola where the reflector wall is thickest. In a few specimens, a high-density material of unknown origin occupied the whole lumen of the anterior caecum, wherein the predominant R-cells contained large lipid droplets, and the lumen of the middle part of the midgut (zone II) was filled with fragments of crustacean cuticle. In other specimens, the lumen of both the anterior caecum and the zone II was mostly empty with only sparse, minute (<< 1 μm) particles.

These observations suggest a specialization of the anterior caecum and a possible use of optical information in food detection by *Cephalophanes*.

2. Functional morphology of feeding appendages and digestive tract, food habits, and swimming behavior in the deep-sea copepods

The copepod family Augaptilidae compresses 10 genera, inhabiting mostly in the meso- and bathypelagic zone of the world oceans. Among these the Genus *Euaugaptilus* encompasses about 70 species and many of them (>50%) occurs sympatrically. Many species of this genus, as well as of some other related genera, possess rows of sucker-like structure on their feeding appendages, called "button seate", suggesting a specialization in feeding habits of these copepods which would also be related to the high species diversity in this particular group. However, our knowledge on the structure and function of the button setae are fragmentary, and almost nothing is known of their swimming behavior.

During this cruise we collected deep-sea copepods, and examined the structure of the button seate and digestive tracts, and gut contents of *Euugaptilus* spp. The swimming behavior of some deep-sea copepods, including augaptilids, were also analyzed by using a video recorder.

Immediately after collection, specimens of augaptilids were sorted from the plankton samples and prepared for SEM and TEM as above. Live deep-sea copepods were transferred to bottles containing filtered seawater and kept in a cold room (5 °C) until observation and recording of their swimming behavior.

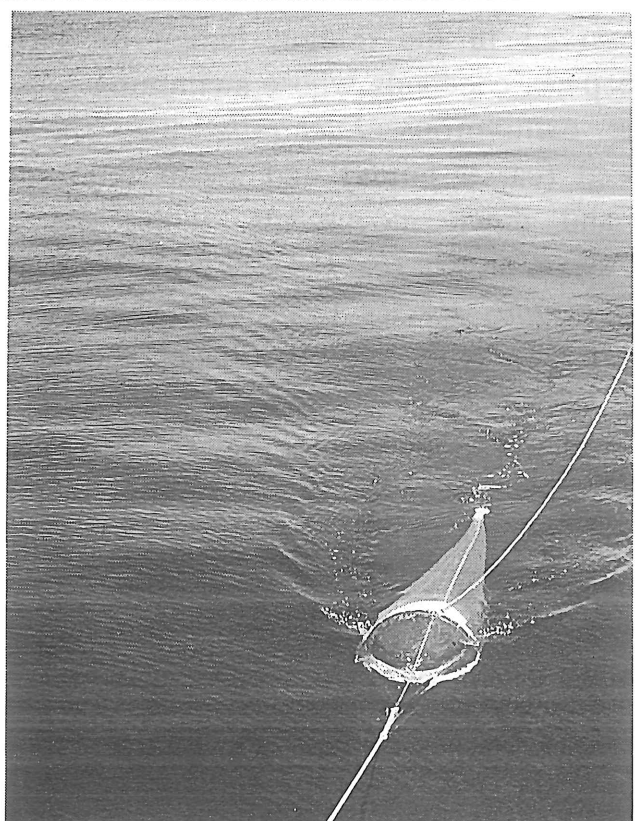
The button seate on the maxilla and maxilliped of three *Euaugaptilus* species were examined. There were differences in shape and arrangement of the "buttons" between corresponding appendages of the three species, while no marked differences were detected between the buttons on the maxilla and maxilliped of the same species. Each button consists of a "umbrella" and a "stalk" supporting the former, and the whole components of the button, including the setal shaft, are enclosed in an electron-sparse membrane. The digestive tract of *Euaugaptilus* spp. was basically similar to those in epipelagic copepods in the gross morphology and the epithelial-cell types, except that the R-cells often contained large lipid droplets. Light microscopic observations revealed no identifiable material in the midguts, while multiplied thin membranes of unknown origin were frequently observed in the midgut lumen of TEM sections. Among the deep-sea copepods whose swimming behaviors were examined, the carnivorous *Euchirella* spp. showed a high swimming speed (ca. 8 mm/s) and swam intermittently with repeated up and down movements, while the omnivorous *Lucicutia* spp. swam slowly (ca. 0.3-2.5 mm/s) but continuously. The three *Euaugaptilus* species swam very slowly (< 0.4 mm/s) relative to their size, with some specimens showing almost no movements.

The present observations suggest that *Euaugaptilus* spp. adopt an ambush predation mode for their foraging in the resource-limited deep sea, and the button setae are effective in capture of food organisms.

3. Feeding ecology of pelagic amphipods

Many species of the pelagic amphipods migrate vertically over considerable distances, and are considered as important zooplankton in vertical matter transfer in the ocean, wherein their feeding ecology is essential. However, little is known of the feeding ecology of the amphipods in the tropical and subtropical waters. In this cruise collection and observation were made on pelagic amphipods to fill this gap.

Plankton samples were collected at the stations around the Arakane and Pathfinder Reefs and at St. 77 during the second leg. Pelagic amphipods were sorted immediately after collection and prepared as above for analyses of feeding structure and gut contents with SEM and TEM. Some amphipods were kept alive in filtered seawater, and their fecal pellets were recovered and fixed as above, or in formalin-seawater, for food-habit analysis. A part of the amphipods from St. 77 were kept frozen (-80 °C) for analysis of chemical composition. Live amphipods from St. 77 were also kept in filtered seawater and their swimming behaviors were recorded.



Phylogeography of the open ocean: A case study using a circumglobal mesopelagic fish *Cyclothone alba* (family Gonostomatidae)

Masaki Miya and Akira Kawaguchi

Unlike neritic species, those inhabiting open oceans generally occupy broad distribution ranges, extending from a portion of a single ocean basin to entire oceans. Biologists have readily accepted the monospecific status of such oceanic species as the natural consequence of their potential for dispersal across great distances via ocean currents. Indeed, few examples of strictly cryptic species are known in the oceanic environment. Recently Miya and Nishida (1997) demonstrated the first evidence for unexpectedly large, localized genetic differences within a circumglobal, highly monotypic species (*Cyclothone alba*) in the oceanic pelagic realm Also their study suggested that there were two genetically distinct, allopatric populations in *C. alba* from the western North Pacific.

In an attempt to examine more fine-scale genetic structure of the two western North Pacific populations of *Cyclothone alba* and to corroborate a hypothesis that the two populations are geographically isolated by the subtropical front, we conducted a series of six oblique tows using a 10-foot Isaacs-Kidd midwater trawl to depths of approximately 500-1000 m between 25° N and 15° N All fish specimens (excluding larvae) were sorted immediately after collection, preserved in 99.5% ethanol. Subsequently they were primarily sorted into taxonomic categories ranging from families to species.

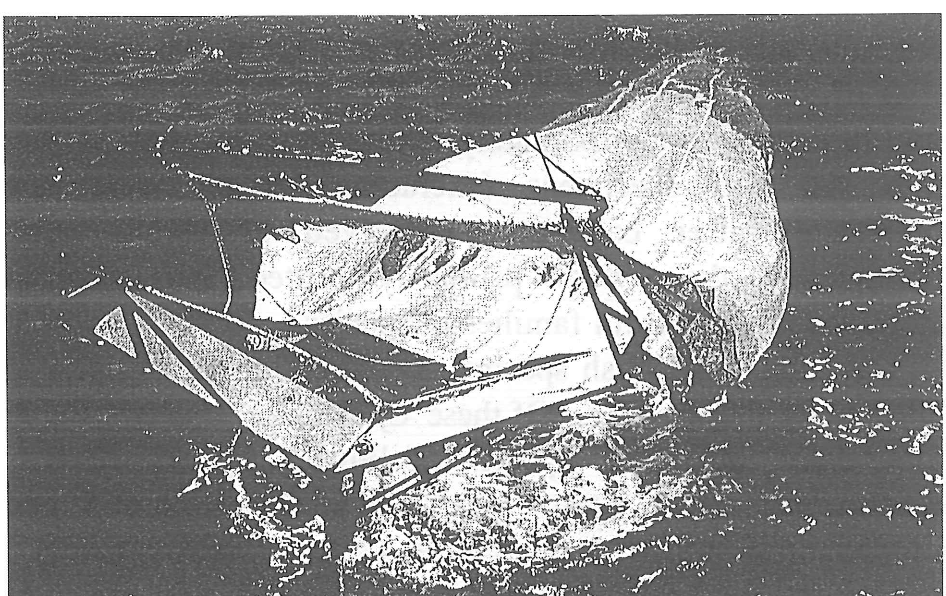
A total of 930 fish specimens comprising >30 species were collected by the six tows. Of these *Cyclothone alba* was the most numerically abundant species, followed by *C.pallida*, *C. pseudopallida*, and *C. atraria* (see Table). A portion of 5' end of mitochondrial 16SrRNA gene from *C. alba* (approximately 350 bp) is currently being amplified and sequenced, with which fine-scale genetic structure will be revealed. Also some aulopiform and myctophid specimens collected during the cruise are being served as materials for molecular phylogenetic studies.

Reference

Miya, M. and M. Nishida. (1997) Speciation in the open ocean. *Nature*, **389**: 803-804.

Table. Number of specimens fpr *Cyclothone* species collected during a KH-98-2 cruise

Species	St.4	St.6	St.7	St.8	St.9	St.12	Total
Cyclothone alba	23	38	19	29	62	17	188
C. pseudopallida	20	12	2	3	3	3	43
C. pallida	2	20	14	25	44	39	143
C. atararia	12	0	0	1	0	0	13



Morphology of the central and peripheral nervous systems of pelagic fishes

Seiji Ohshimo

Five families (Engraulididae, Istiophoridae, Scombridae, Gempylidae and Trichiuridae) of pelagic fishes larvae were collected by IKMT net or ORI net trawlings on Hakuho Maru Cruise (KH-98-2). These samples were sorted on board and fixed in 4% paraformaldehyde and 2% glutaraldehyde, 10% neutral formaldehyde and 100% ethylalchole. After the identification of the fish species, the morphological characters of the central and peripheral nervous systems were studied by histological methods.

The morphology of central nervous and peripheral nervous systems were varied by the behavioural patterns (Uchihashi, 1953; Brandstatter and Kotrschal, 1990; Illick, 1956). The morphologies of the brain of 4 genera in the Engraulididae also differed each other, but the cranial nerves pattern were basically same (Ohshimo unpublished). In the present study, the ontogenetically and phylogenetically variation of the nervous systems of the pelagic fishes were studied.

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Illick, H. J. 1956. A comparative study of the cephalic lateral-line system of North American Cyprinidae. *Am. Midland Nat.*, **56**: 204-223.

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Observation of drifter buoy

Tadashi Inagaki, Takashi Inoue, Jun Aoyama, Satosi Ishikawa, Machiko Oya, Shun Watanabe, Tatsuki Yoshinaga, Seiji Sasai, Jun Inoue, Akira Shinoda, Yobuo Kimura, Takeshi Miyai and Katsumi Tsukamoto

Observation of drifter buoy (satellite tracking type: ARGOS) was carried out for a following two purpose:(1) To examine transportation environment of egg and larvae of *Anguilla japonica* in their spawning area : (2) To get migration course information of adult eel from East Asia to spawning area. According to a purpose, the drifter buoys with underwater drogue were deployed to flow along sub-surface water (80m depth:set A) and mid-depth water (160m and 250m depth:set B and C) and were tracked about for 90 days.

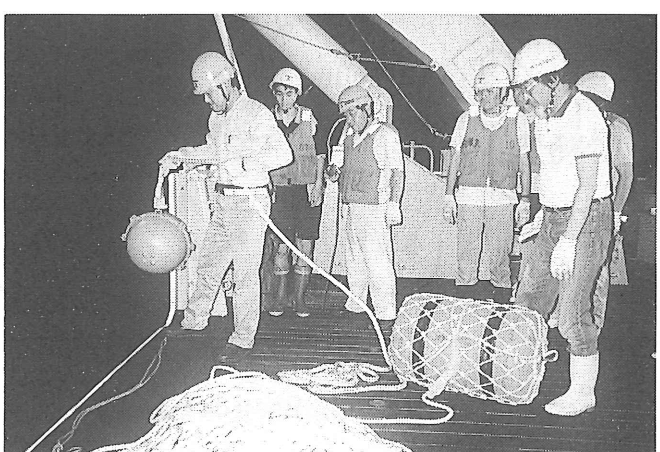
(1)Flow in the spawning area

In this area, 8 drifter buoys were released along 142° E line off west of Sea mounts (Pathfinder, Arakane and Suruga) at 13.5° N(St.A5:set B), 14.5° N(St.A4:set A and B), 15.5° N(St.A3:A and B set) , 16.5° N(St.A2:set A and B) and 17.5° N(St.A1:set B) in 28th and 29th May. Fig.1 shows results of drifter's trajectories except for St.A1 in about 90 days:upper shows sub-surface flow (set A) and lower shows mid-depth flow (set B). Complex flows were shown by a difference of release point and drogue depth, and buoys flowed westward in North Equatorial Current (NEC) except for one finally. Fig.2 shows trajectories of drifters near the Sea mounts in the early period except for north end one(St.A2). South end buoy(St.A5) in depth of 160m flowed westward along NEC, but other 4 buoys flowed northward at the start,and those went to the east afterwards, and furthermore 3 buoys went around the Sea mount clockwise later . On the other hand, north end Buoys (St.A2) were transported to northwestward with an eddy of 11 days period (Fig.1).

In future, these results are used with birthday data of eel larvae sampled and CTD data conducted in this cruis for estimate analysis of spawning place and transportation analysis of eel larvae.

(2)Flow near the Ogasawara Island

Two set of drifter buoy (set A and C) were released at St.A6 (27° 00'N,141° 54'E) to get migration course information of adult eel in 29th June. These results show in Fig.3.



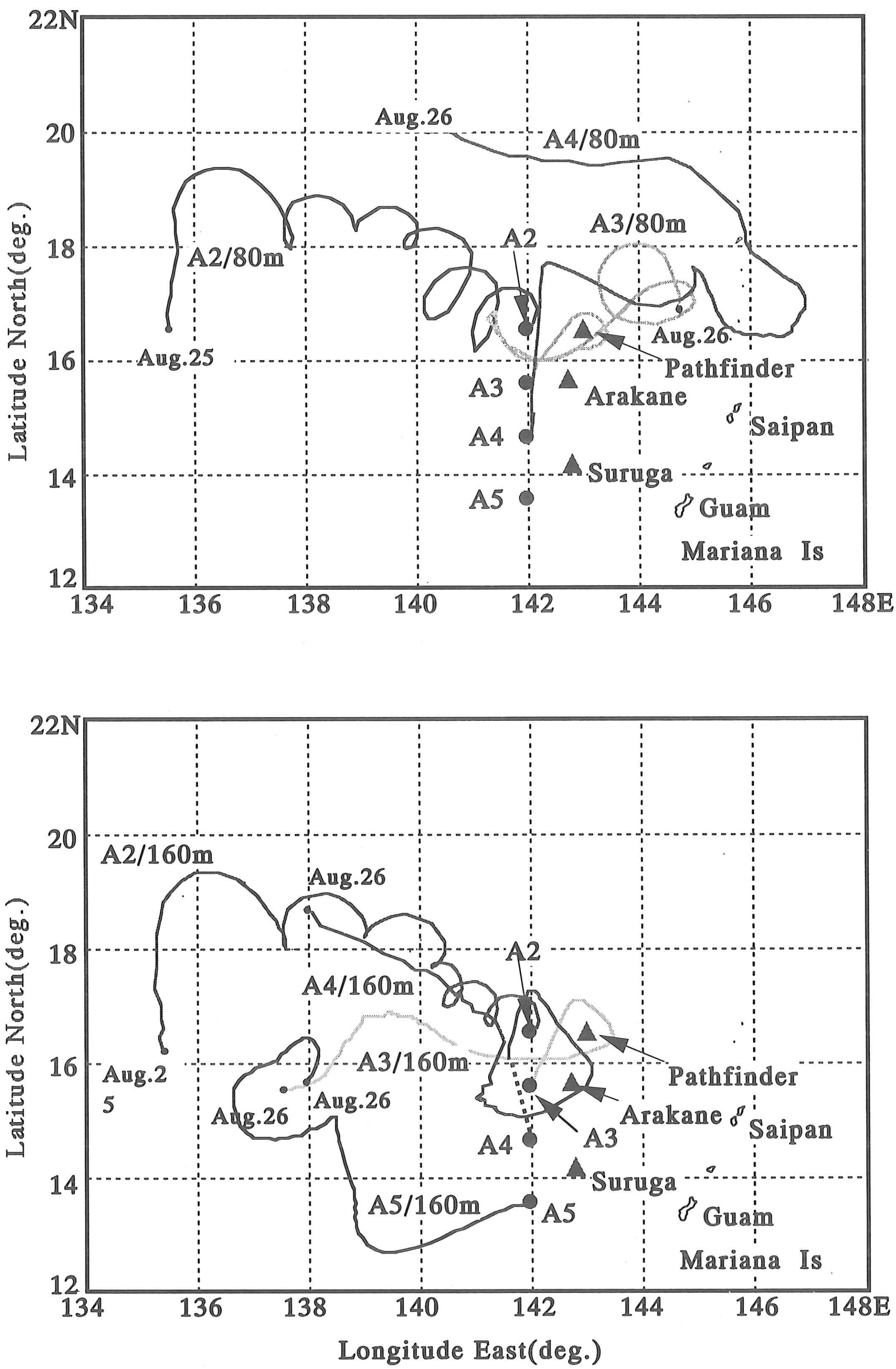


Fig.1 Trajectories of 6 ARGOS buoy in N.E.C among 90 days

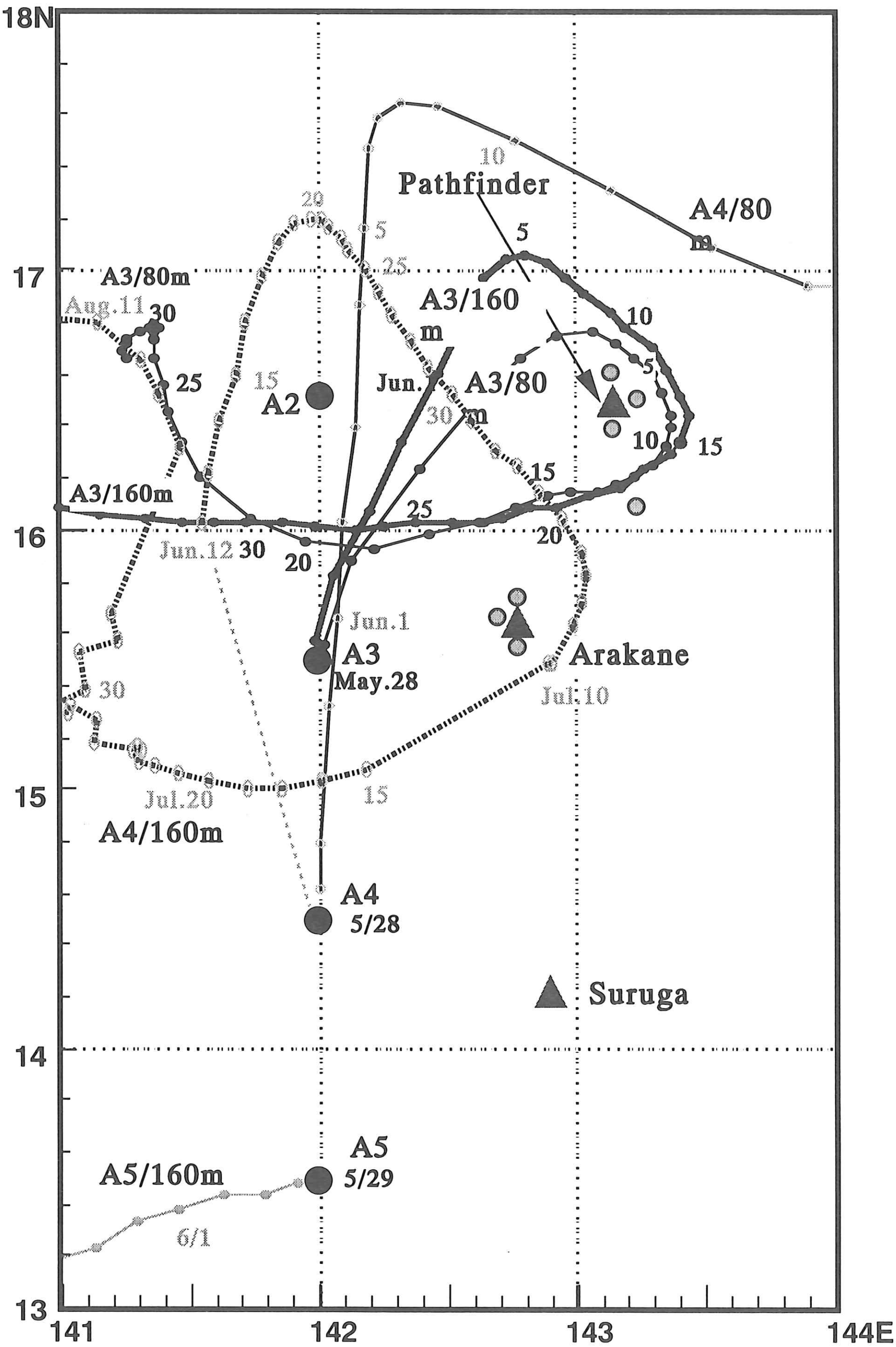


Fig.2 Trajectories of 4 ARGOS buoy near 3 seamounts.

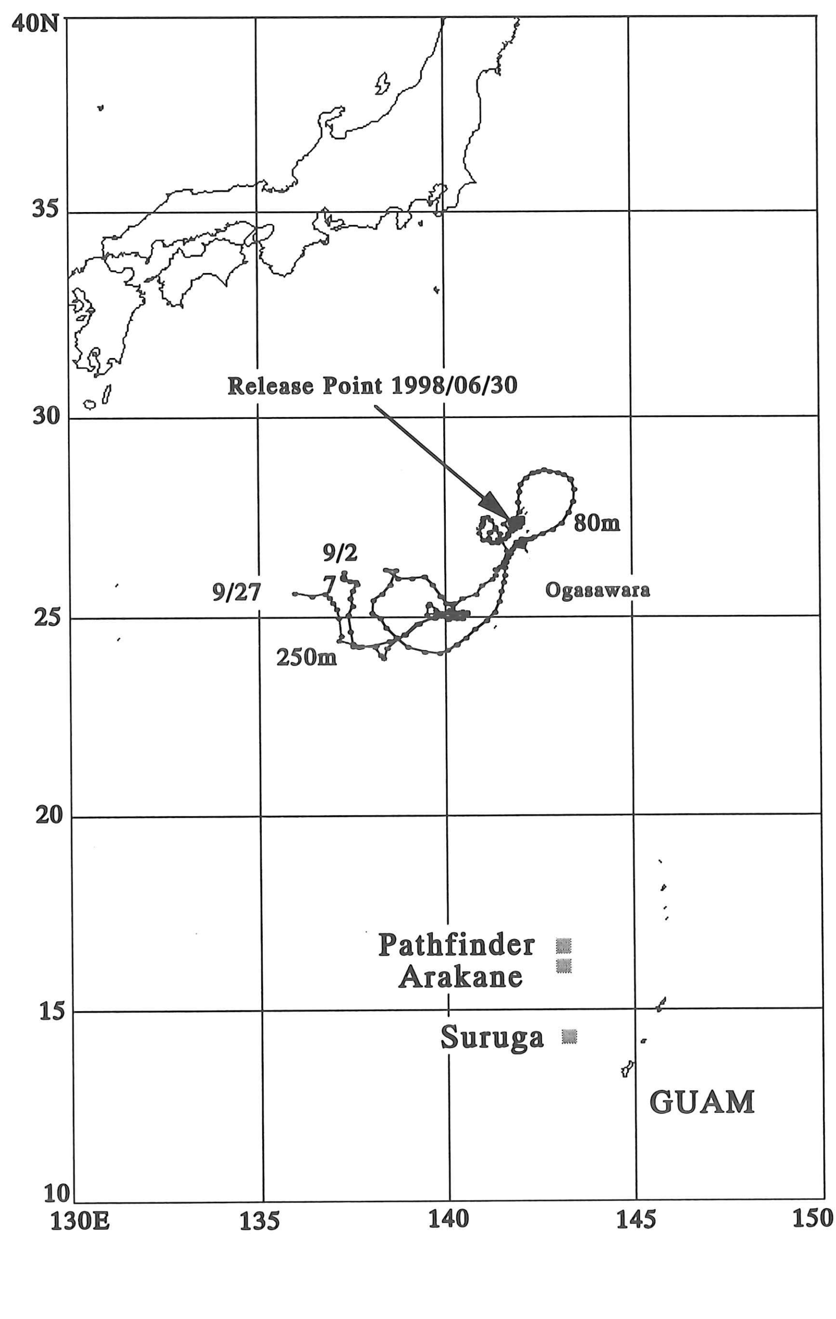


Fig. 3 Trajectories of ARGOS Buoy in Ogasawara area

V. Leg.2
Eel survey and eel spawning

Hans Fricke, Katsumi Tsukamoto, Juergen Schauer,
Karen Hissmann, Tadashi Inagaki, Jun Aoyama
and Satoshi Ishikawa

The JAGO dives focused on a detailed survey around the two seamounts (SMs) Arakane and Pathfinder as possible locations of the proposed eel spawning grounds. We selected two observation periods: in the morning 8.00-11.00 am, in the evening 18.00-23.00 pm. All events were recorded with video cameras, 35 mm still cameras, tape recorders or handwritten notes. A standard handwritten protocol reported about diving depth, temperature and changes in current direction and velocity. Furthermore a depth-temperature recorder attached to the submersible monitored all JAGO-dive profiles. In order to ascertain the suitability of the bottom as shelter site for eels, long video recordings and transects were run horizontally but also oblique to the slope. The dive sites were selected according to suitability for an easy submersible launching but also to cover most parts of the SMs slope. The JAGO-dive-log lists details of each dive (table 1).

During all dives we encountered in shallow water prevailing E-W currents, in deep water below in average 170-200 m depth horizontal N-S currents but also S-N currents of moderate velocity. However, frequently up- and downwellings were encountered and uprupt changes in current direction and velocity were noticed. Particular dramatic current changes occurred on the Northern part of Arakane SM where JAGO experienced an underwater storm with temperature changes of 8℃ within the same depth. Still water of short durations were found below the thermocline at 170-200 m depth.

The slopes of both SMs are extremely steep with an average angle of 45 to 60 degrees, on many places with vertical drop offs. The slopes showed around the SMs signs of ongoing erosion and recent turbidity flows. In average the slopes were smooth and offered very few hiding places for eels. Heavy material transports originating from the shallow carbonate platform produced boulder zones consisting mainly of rounded coral heads accumulating along the slopes or in erosional scares at various depth. They could act as shelter sites for eels. However, such shelter zones are minor in extend and might cover in total only few percent of the entire slope area.

During all our dives we did not encounter any eels, neither at night nor during the day. We can safely conclude that the slopes of Arakane and Pathfinder (and also Stringray SM) between 100-400 m depth are unsuitable as shelter places for arriving or migrating eels. On June 21 we started echoprofil surveys with the help of the FURUNO "Acoustic Biomass Investigation System" using 50 kHz frequency. We recorded at Arakane on June 21 above 400 m slope at 250 m depth a dense fish cloud, on June 23 at Pathfinder one aggregation between 200-240 m above 280 m depth, another between 200-225 m above 260 m ground. We were not able to identify with the help of JAGO if these assemblages were spawning aggregations of eels. A huge scattered cloud discovered on Pathfinder on June 27 at 19.00 pm at 150 m depth above 300 m ground did not resemble the clouds previously encountered. The cloud drifted to the surface and disintegrated rapidly. A bounce dive by JAGO (project dive No. 26) revealed sardines as the origin of the echo signals.

In future the nature and origin of these echo signals around New Moon should be more thoroughly studied.

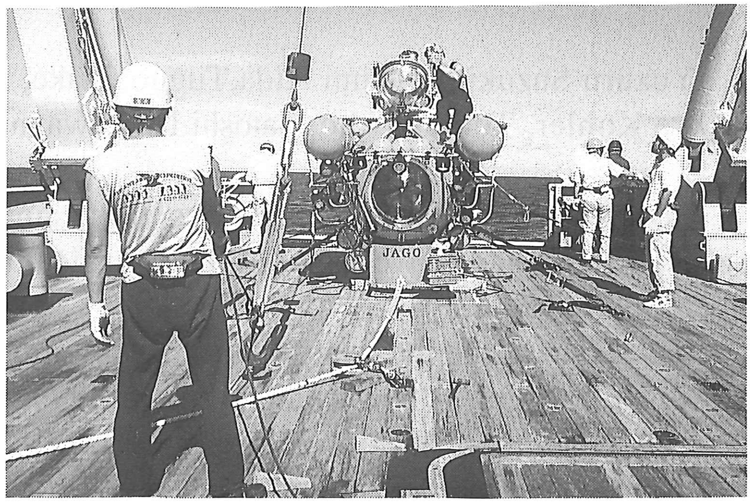
Table 1. JAGO diving list in KH-98-2

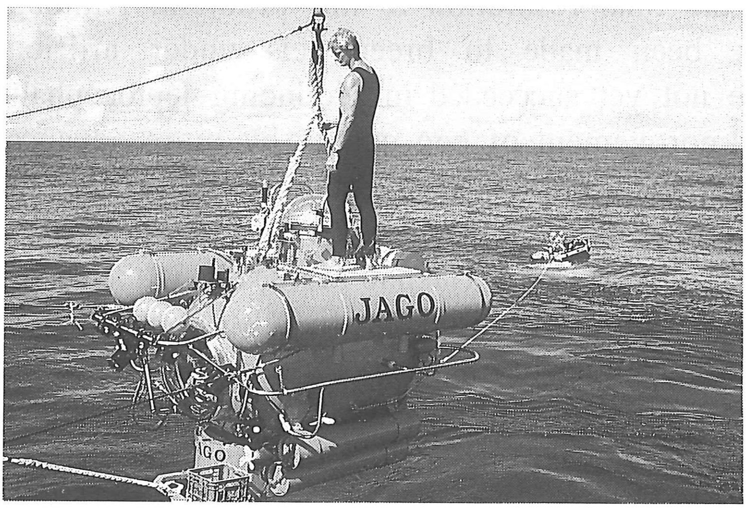
JAGO Dive No	Project Dive No	Date	Location	Pos. down JAGO-GPS	Tokyo-GPS	Pos. up JAGO-GPS	Tokyo-GPS	Time down/up	Duration (min)	Min. Depth	Max. Depth	Pilot	Observer	Remarks
551	Test	9-6-98	Arakane	15.37.49	15.37.16	-	-	14:12	131	36	375	Schauer	Fricke	Test dive
			west	142.45.25	142.45.45	-	-	16:23						
552	1	10-6-98	Arakane	15.38.13	15.37.79	15.38.02	15.37.69	9:50	188	20	315	Schauer	Fricke	Eel survey and release of first tagged eel (TR1/CH11)
			west	142.45.48	142.45.68	142.46.21	142.45.41	12:58						at 324m, 13.2 degrees C
553	2	10-6-98	Arakane	15.38.06	15.37.73	15.38.18	15.37.85	16:25	105	14	350	Schauer	Tsukamoto	Eel survey, transparent Ateleodiformes
			west	142.45.47	142.45.67	142.45.28	142.45.48	18:10						(= "chimaera fish")
554	3	11-6-98	Arakane	15.37.95	15.37.62	15.37.40	15.37.07	17:06	249	195	400	Schauer	Fricke	Eel survey and biodiversity video profile from 392
			east-south	142.46.01	14246.21	142.45.36	142.45.56	21:15						to 180 m depth
555	4	12-6-98	Arakane	15.38.03	15.37.69	15.37.92	15.37.59	8:36	140	100	211	Schauer	Tsukamoto	Release of second tagged eel (TR2/CH10) at 220 m,
			east	142.45.93	142.46.12	142.45.76	142.45.96	10:56						biodiversity video profile from 160 to 30 m depth
556	5	12-6-98	Arakane	15.37.93	15.37.60	15.37.59	15.37.26	18:04	227	70	285	Schauer	Fricke	Eel survey, sessile ctenophore with 3 m long tentacles,
			east-south	142.45.88	142.46.08	142.45.55	142.45.75	21:51						detecting eel TR1 in 162 m
557	6	13-6-98	Arakane	15.38.37	15.38.04	15.38.35	15.38.02	18:12	266	98	400	Schauer	Fricke	Eel survey, strong current from various directions;
			north	142.45.74	142.45.94	142.45.82	142.46.02	22:38						detecting signal from unknown transmitter on CH11
558	7	14-6-98	Arakane	15.37.91	15.37.58	15.38.09	15.37.76	8:50	184	35	200	Schauer	Aoyama	Release of third tagged eel (TR3/CH9) at 176 m,
			east	142.45.98	142.46.18	142.45.84	142.46.04	11:24						24.4 degree C
559	8	14-6-98	Arakane	15.38.04	15.37.71	15.38.05	15.37.72	18:12	269	20	400	Schauer	Tsukamoto	Drift over top of reef east to west, eel survey
			top/s-w	142.45.79	142.45.99	142.45.10	142.45.30	22:31						in pebble/bolder area, small eel with "flag-tail"
560	9	15-6-98	Pathfinder	16.30.47	16.30.14	-	-	18:22	255	60	385	Schauer	Fricke	Strong currents, overhangs, collect sponges at 349 m,
			east	143.09.35	143.09.55	-	-	22:37						corals at 149 m, unknown signal on CH7/50 kHz
561	10	16-6-98	Pathfinder	16.30.38	16.30.05	16.30.61	16.30.28	8:46	119	35	225	Schauer	Ishikawa	Release of fourth tagged eel (TR4/CH8)
			east	143.09.44	143.09.64	143.09.54	143.09.74	10:45						
562	11	16-6-98	Pathfinder	16.30.34	16.30.01	16.30.34	16.30.01	18:16	261	56	400	Schauer	Tsukamoto	Eel survey, collecting sponges
			west	143.08.57	143.08.77	143.08.57	143.08.77	22:37						
563	12	17-6-98	Pathfinder	16.30.74	16.30.41	16.30.44	16.30.11	18:46	222	133	385	Schauer	Hissmann	Eel survey, biodiversity survey - structured slope with
			north	143.08.66	143.08.86	142.08.55	142.08.75	22:28						bolders: ctenophores, Ateleodiformes, Antipathariens
564	13	18-6-98	Arakane	15.37.86	15.37.53	15.38.22	15.37.89	9:24	118	38	218	Schauer	Tsukamoto	Release of fifth tagged eel (TR5/CH7)
			south-west	142.45.38	142.45.58	142.45.38	142.45.58	11:22						
565	14	18-6-98	Arakane	15.37.66	15.37.33	15.38.42	15.38.09	18:16	270	80	316	Schauer	Tsukamoto	Eel survey
			south/west	142.45.66	142.45.86	142.45.51	142.45.71	22:46						
566	15	19-6-98	Pathfinder	16.29.99	16.29.66	16.30.21	16.29.88	18:18	261	115	400	Schauer	Fricke	Eel survey
			south	143.08.89	143.09.09	143.08.54	143.08.74	22:39						
567	16	20-6-98	Pathfinder	16.30.15	16.29.82	16.30.63	16.30.30	18:12	270	82	400	Schauer	Aoyama	Eel survey, collecting huge sponges
			east-south	143.09.11	143.09.31	143.08.90	143.09.10	22:42						
568	17	21-6-98	Pathfinder	16.30.63	16.30.30	16.29.82	16.29.49	18:14	269	80	385	Schauer	Ishikawa	Eel survey
			north-east	143.09.03	143.09.23	143.08.61	143.08.81	22:43						
569	18	22-6-98	Pathfinder	16.30.14	16.29.81	16.30.14	16.29.43	8:28	166	140	400	Schauer	Tsukamoto	Eel survey
			south	143.09.22	143.09.42	143.09.22	143.08.52	11:14						

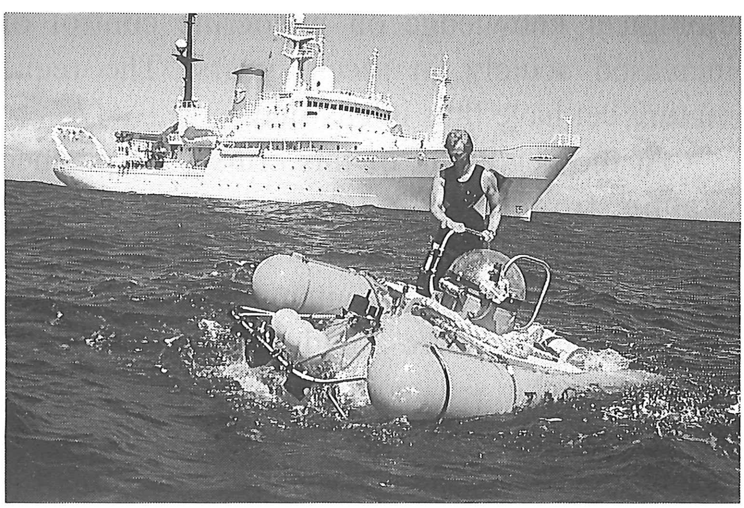
Table 1. JAGO diving list in KH-98-2

570	19	22-6-98	Arakane	16.37.87	16.37.54	15.37.78	15.37.45	17:07	211	25	400	Schauer	Fricke	Eel survey, current from various directions,
			south	142.45.69	143.45.89	142.45.30	142.45.50	20:38						lost eel traps deployed by Suruga-Maru 1997
571	20	23-6-98	Pathfinder	16.30.55	16.30.22	16.30.53	16.30.20	8:13	201	20	400	Schauer	Hassenpflug	Eel survey, current from different directions,
			north-east	143.09.24	143.09.43	143.09.63	143.09.83	11:34						deep sea ray
572	21	23-6-98	Pathfinder	16.30.29	16.29.96	16.30.53	16.30.20	17:06	200	44	400	Schauer	Tsukamoto	Eel survey, deep sea shark
			east-south	143.09.25	143.09.45	143.09.63	143.09.83	20:26						
573	22	24-6-98	Arakane	15.38.27	15.37.94	15.38.37	15.38.04	8:08	145	20	400	Schauer	Tsukamoto	Eel survey, red mushroom-like corals
			north	142.45.79	142.45.99	142.45.94	142.46.14	10:33						
574	23	24-6-98	Arakane	15.37.80	15.37.47	15.38.40	15.38.07	18:06	153	300	400	Schauer	Fricke	Eel survey
			east	142.45.18	142.45.38	142.45.37	142.45.57	20:39						
575	24	25-6-98	Pathfinder	16.29.96	16.29.63	16.30.07	16.29.74	20:43	135	200	390	Schauer	Tsukamoto	Eel survey
			south	143.08.93	143.09.13	143.09.08	143.09.28	22:23						
576	25	26-6-98	Arakane	15.38.32	15.37.99	15.38.47	15.38.14	20:11	137	40	400	Schauer	Tsukamoto	Eel survey
			north	142.45.78	142.45.98	142.46.12	142.46.32	22:28						
577	26	27-6-98	Pathfinder	16.30.24	16.29.91	-	-	18:15	63	-	159	Schauer	Tsukamoto	Search for echo sounder signal in open water,
			east	143.08.34	143.08.54	-	-	19:18						school of sardines
578	27	28-6-98	Stingray	20.29.65	20.29.32	20.29.25	20.28.92	19:25	260	66	400	Schauer	Fricke	Biodiversity survey, collection of sedentaria "trees"
			east-south	142.26.49	142.26.69	142.26.18	142.26.38	23:45						
								Total dive time (min)	5475					
									91 hours					

14 dives at Arakane, 12 dives at Pathfinder, 1 dive at Stingray, 1 test dive at Arakane
18 dusk/night dives, 8 morning dives
21 dives below 300 m depth


JAGO


JAGO



Adult eel sampling

Yuzuru Suzuki, Katsumi Aida,Tuguo Otake, P. Mark Lokman,
Uwe Kohler, Tomoko Uto, Satoshi Ishikawa, and Tadashi Inagaki

During the cruise, we made two trials aimed at catching adult eels. Unfortunately, we failed. Many difficulties arose related to operating the eel trap.

Eel is one of the most important fish for aquaculture in Japan. However, farming is now facing a big problem; the number of glass eels for cultivation has been decreasing acutely year by year, along the coast of Japan. Developing a technique for control of its whole life cycle must be the final resolution to this problem. Although many efforts have been made to breed eels under artificial conditions, we have not yet succeeded in producing leptocephalus larvae nor elvers. Improvement of egg quality by more advanced methods of artificial control of the eel endocrine system is thus important. Information from naturally mature eels is highly needed.

Following the KH94-2 cruise by Hakuho Maru, this is the second trial aimed at catching adult eels using artificially mature fish as lures. We had high expectations during this cruise, since the position and the period of spawning can now be far more accurately estimated than during the former cruise. In addition, many tools for analysis of adult eels have been developed. In particular, molecular biological knowledge on endocrine control of eel maturation has increased acutely in recent years. The requests for analyzing a mature eel have thus intensified.

At the beginning of this cruise, we planned to set a trap for eel capture from the JAGO, just along the eel spawning ground. However, the information from the exploratory JAGO dive along the slope of the sea mountains showed the difficulty in setting any trapping devices. We could neither find any caves or holes on the surface of the sea mount suitable for trap setting, nor the exact position of spawning eels. In addition, the strong currents around the sea mount would make it impossible to set the trapping devices. Hence, we had to abandon the original plan.

Given these conditions, we twice tried to catch adults, not using JAGO. A unit of traps used in this cruise was made of eel pot reported previously (Inada et al., Prelim. Rep. KH94-2, 1995). The eel pot was made of gray plastic pipe, 1000mm in length and 140mm in diameter. Both ends of the pipe were covered with funnels of black thin plastic, which was split into several pieces at the top to act as a non return valve.

The first trial was made at the summit of the seamount Pathfinder Reef on June 17. A trap, made with a bundle of 10 eel pots, was set in a small cave by divers. In two pots were artificially matured males were placed, a further two were baited with eel ovary collected from an artificially matured female. The procedures for induction of maturation are described elsewhere (Uto et al., in this issue). This trap was recovered after 2days, on June 19, but no eel nor other animals were caught. In addition, one male eel as decoy had disappeared.

The second trial was carried out along the slope of the seamount Pathfinder Reef on June 19. This trap system consisted of a 200m rope, with a surface buoy and a pole with a flag at one end of the rope, two anchor weights set off both sides of the rope, and 10 eel pots attached randomly to the rope. One end, with the buoy and one weight, was dropped onto the south edge of the top of the sea mount. Thereafter the rope was thrown down to be anchored onto the southern slope of the seamount by the second weight. Three artificially matured males, four pieces of eel ovary from artificially matured fish, and two dead horse mackerel were put into the pots, as attractants. On day June 20, we could not find the trap at the set position we set as it had drifted by the strong current around the sea mount. We later found the floating trap and retrieved it. However, no animals were captured.

These two trials show the difficulties to catch adult eel at the spawning ground. The severe current conditions and extraordinary smooth surfaces of the seamount require more sophisticated capturing facilities.

Sampling of *Anguilla japonica* eggs around Seamounts area

Satoshi ISHIKAWA, Tsuguo OTAKE, Noritaka MOCHIOKA, Yuzuru SUZUKI, Jun AOYAMA, Shun WATANABE, Tatsuki YOSHINAGA, Jun INOUE, Akira SHINODA, and Takeshi MIYAI

The spawning area of Japanese eel *Anguilla japonica* was assumed to be in the North Equatorial Current west of the Mariana Islands, at a salinity front near 15° N, 154° E by measuring oceanographic conditions and collecting their larvae. If the some eggs of Japanese eel are collected in the spawning area, the exact location of their spawning points were discovered. So, in order to obtain the eggs of Japanese eel, we collected many eggs by ORI-net and IKPT, around two sea mounts which are assumed to be a spawning points of *A. japonica*.

1. Selection of Anguilliformes eggs

Since no eggs of freshwater eels including *A. japonica* have been collected, the morphological traits of them, for example egg diameter, number of oil droplet and color of embryo etc., were still unknown. It is impossible to distinguish the eegs of Japanese eel from other fish eggs in net samples according to only morphological data. Therefore, first we picked up the eggs assumed to be Anguilliformes, which have wide perivitelline and are larger than 1.0mm in diameter. Second, these eggs were divided into some types by morphological features(Table 1). Then, these types were identified by following two methods.

2. Egg type identification

Some types of eggs were identified according the morphological data of their larvae which are obtained through the egg incubation. The identification of the type of eggs which were morphologically similar to the Japanese eel egg obtained by artificial maturation, were done using the mitochondrial DNA (mtDNA) sequence data.

In this cruise, total 293 eggs assumed to be Anguilliformes were collected from 77 nets (Table 2). These eggs were divided into 11 types according to the egg diameter, the number of oil droplets, the color and distribution of oil droplets, and the color of embryo (Table 1). The eggs of type No.1 and No.4 were identified to be Muraenidae, and Serrivomeridae or Derichthyidae, respectively, by measuring the morphological features of their larvae obtained after egg incubation. Most of all these eggs were in early developmental stage, they were probably spawned in few days before their sampling time. This suggest at least some Anguillidae species spawn around these sea mounts.

The three eggs of type No.11 were morphologically similar to artificially eggs of *A. japonica*. DNA sequences including the part of 16SrRNA region of mtDNA of these three eggs were compared with the mtDNA sequences of all species of Anguilldae, one species of Congridae, one speceis of Serrivomeridae, and one species of Muraenidae. The mean of sequence difference among No.11 eggs was 0.35%, and that between eggs and all species of Anguillidae was 8.55%. Concerning the mean of sequence differences among Anguillidae was 3.50%, these three eggs are not of Anguillidae. But, that among Serrivomidae, Muraenidae and Congridae was 16.3%. The mean of sequence differences between three eggs and Serrivomidae was 6.5%. It is say that the three eggs are one of Anguilliformes spices. The number of pair wise sequence differences of all pairs were shown in Fig. 1. This results emphasize the difficulties of identification of eggs according to only morphological data. Thus, not only the morphological data but also molecular data should be used for the egg identification.

3. Distribution of eggs

Around Arakane sea mount, more eggs were collected from southern and western area than that from eastern and northern area(Table 3). On the other hand, around Pathfinder sea mount, the number of eggs collected from northern and eastern area was larger than that from rest area (Table 3). This indicate that the egg distribution around sea mount are not uniformity among all direction areas. The clockwise flow around Arakane sea mount, and that from northeastern area to southwestern area of Pathfinder sea mount were observed (ref. Inagaki et al. in this report). The distribution of eggs of Anguilliformes are probably influenced by current system around spawning points.

Table 1. Morphological features of each egg type

Type No.	Egg Diameter	Color of embryo	Oil droplet Number	Oil droplet color	note
NO.1	>3.0mm	clear	0	clear	eggs are assumed to be Muraenidae
NO.2	1.0-2.0mm	clear	1	yellow	
NO.3	3.0mm	clear	1	yellow or clear	
No.4	3.0mm	clear	>5	clear	oil droplets are scattering
No.5	2.0mm	clear	4	clear	oil droplets are scattering
NO.6	>3.0mm	yellow	0	clear	
NO.7	1.0-2.0mm	clear	0	clear	
NO.8	2.0mm	clear	>5	clear	oil droplets are concentrated
NO.9	2.0mm	clear	3	clear	
NO.10	2.0mm	yellow	>5	yellow	oil droplets are concentrated
NO.11	2.2mm	clear	1	clear	similar to the artificial egg of *A. japonica*

Table 3. The number of eggs collected from each direction area around Arakane and Pathfinder Seamount

	Northen	Eaetern	Southern	Western
Arakane	2(2)	4(4)	22(5)	44(5)
Pathfinder	43(8)	90(9)	17(6)	10(3)

Figure 1 Number of pairwise sequence differences.

No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	Type-11 (No.996)	-																					
2	Type-11 (No.995)	3																					
3	Type-11 (No.975)	2	0																				
4	A. japonica	43	44	41																			
5	A. marmorata	42	45	42	25																		
6	A. bicolor pacifica	43	44	41	20	8																	
7	A. celebesensis	44	43	42	22	15	13																
8	A. bornensis	45	46	43	26	29	23	24															
9	A. interioris	43	44	41	23	8	6	15	28														
10	A. reinhardti	37	38	35	16	16	13	15	17	16													
11	A. australis australis	38	40	37	23	18	18	21	26	19	12												
12	A. australis shmidit	36	38	35	25	20	20	22	26	21	12	2											
13	A. diffenbichi	40	41	38	22	20	19	23	24	22	11	12	12										
14	A. megastoma	42	41	38	17	17	16	15	21	19	9	14	16	17									
15	A. obscura	41	42	39	22	7	5	14	25	9	15	20	22	21	16								
16	A. rostrata	38	41	38	20	15	17	15	20	20	10	18	18	17	13	16							
17	A. anguilla	39	40	37	16	14	16	14	18	17	6	13	13	13	9	16	7						
18	A. bicolor bicolor	44	45	42	21	9	1	14	24	7	14	19	21	20	17	6	18	17					
19	A. mossambica	40	41	38	22	17	18	17	21	19	11	17	17	16	15	16	14	10	19				
20	A. nebulosa	46	47	44	25	10	10	19	30	8	18	21	23	24	21	11	22	19	11	21			
21	Serrivomeridae	32	31	30	49	46	46	44	49	46	41	45	43	45	44	43	42	41	45	44	50		
22	Muraenidae	80	79	71	77	72	76	75	74	76	73	74	74	71	73	76	71	71	75	71	73	85	
23	Congridae	86	87	79	82	85	84	88	80	87	83	78	80	81	79	83	84	82	83	86	83	93	84

Table 2 Station, date, and location of the nets by which the eggs assumed to be Anguilliformes were collected.

ST No.	Date	Net	Reef	Position	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11
24	980611	ORI-side	Arakane	East			1								
25	980611	ORI-side	Arakane	South	1										
28	980613	IKMT	Arakane	South	6										
29	980613	ORI-side	Arakane	West	1	3	1								
29	980613	IKMT	Arakane	West	12		1					1			
30	980613	ORI-side	Arakane	North			1								
33	980615	ORI-side	Ara-Path			5									
34	980616	ORI-side	Pathfinder	West	2	1									
34	980616	IKMT	Pathfinder	West	1										
35	980616	ORI-side	Pathfinder	North	3										
35	980616	IKMT	Pathfinder	North	2	2							1		
36	980616	ORI-side	Pathfinder	East	5	7	2+			5					
36	980616	IKMT	Pathfinder	East	5			3							
37	980616	IKMT	Pathfinder	South				3							
39	980618	ORI-side	Arakane	East					1						
39	980618	IKMT	Arakane	East				1							
40	980618	ORI-side	Arakane	South				1							
41	980618	ORI-side	Arakane	West	5+	1	1					1			
41	980618	IKMT	Arakane	West						1					
42	980620	ORI-side	Pathfinder	North			1		1						
42	980620	IKMT	Pathfinder	North		1									
43	980620	IKMT	Pathfinder	East	3	2	1								
45	980620	IKMT	Pathfinder	North			2								
46	980621	IKMT	Pathfinder	South	4	1		1							
47	980621	ORI-side	Pathfinder	West		5									
48	980621	IKMT	Pathfinder	North	5				1	1		1			
49	980621	ORI-side	Pathfinder	East	11										
49	980621	IKMT	Pathfinder	East	9				1						
50	980622	IKMT	Pathfinder	North	4		3			5					
51	980622	ORI-side	Pathfinder	East	6		5			1					
51	980622	IKMT	Pathfinder	East	3					2	2	1			
52	980622	IKMT	Pathfinder	South	3					2					
54	980622	ORI-side	Arakane	West			2								
54	980622	IKMT	Arakane	West		1									
55	980622	ORI-side	Arakane	South			2								
55	980622	IKMT	Arakane	South	5		2								
56	980622	IKMT	Arakane	West	3										
57	980623	IKMT	Pathfinder	South					1						
58	980623	IKMT	Pathfinder	North					2						
60	980624	IKMT	Arakane	East										1	
61	980624	IKMT	Arakane	South	3				1			1			
62	980625	IKMT	Pathfinder	East	3										1
63	980625	IKMT	Pathfinder	North											2
64	980625	IKMT	Pathfinder	West											1?
65	980625	IKMT	Pathfinder	South	1						1				
66	980625	ORI-side	Pathfinder	East	2										
66	980625	IKMT	Pathfinder	East	5					1					
69	980627(d)	ORI-side	Arakane	West	2					6					
69	980627(d)	IKMT	Arakane	West	1							1			
71	980627(d)	ORI-side	Arakane	North	1										
73	980627(d)	ORI-side	Pathfinder	North						3					
73	980627(d)	IKMT	Pathfinder	North							2				
74	980627(d)	ORI-side	Pathfinder	North						1					
75	980627(n)	ORI-side	Pathfinder	East			1								
75	980627(n)	IKMT	Pathfinder	East	3										
77	980629(d)	ORI-2000									1				

Distribution of *Anguilla japonica* leptocephali around Arakane and Pathfinder Seamounts

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Anguilla japonica leptocephali were collected around Arakane and Pathfinder seamounts using IKPT (10ft, 0.5mm mesh aperture) oblique (surface to 300 or 500m deep) and horizontal step tows. The depth strata of the horizontal step tows were selected on the basis of the location of halocline as observed by CTD casts in each station. Two or three depth strata among 50, 75,100,150,250, 300m were selected in each tow (see Net record in this issue). The towing stations were situated within 0.75 - 3 miles from the top of each seamounts except for three stations between the two seamounts and 14 stations in Leg.1.

A total of 24 *Anguilla japonica* leptocephali (TL:10.0 - 26.0 mm) were collected during the cruise. Two (TL: 10.0, 15.3mm) and two (TL: 10.4, 11.5mm) leptocephali were collected from northern and western areas of Arakane seamount, respectively, and one (TL: 22.0mm) was from the southern area. Five (TL: 16.1 - 18.6mm) and six (TL: 16.3 - 26.0mm) leptocephali were collected from northern and southern areas of Pathfinder seamount, respectively, and two (TL: 15.3, 16.4mm) were from the eastern area. Five leptocephali (TL: 11.0 - 13.0mm) were from stations between the two seamounts. Three leptocephali of 24.7 - 26.0mm TL from southern stations of Pathfinder (Sts. 46,47,51) were estimated to be 50 days old and the other were 14 - 30 days old (Lee et al. in preparation), suggesting that they were spawned around the new moon day of April and May.

Although there found westerly current flow on the whole, ADCP data indicated complex eddies lying around the seamounts (see Hasumoto et al. in this issue). Those facts suggested that the *Anguilla japonica* leptocephali collected from the seamount areas were probably trapped and remained there by complex current systems around those seamounts in the process of the transportation.

Table 1. *Anguilla japonica* leptocephali collected during KH-98-2

No.	Date	Station	Seamount	Area	TL(mm)	TM
1	1998.6.10	18	Arakane	Northen	10.0	113
2	1998.6.10	20	Arakane	Western	11.5	113
3	1998.6.11	22	Arakane	Western	10.4	114
4	1998.6.15	32	Arak-Path		13.0	119
5	1998.6.15	32	Arak-Path		11.0	117
6	1998.6.15	32	Arak-Path		12.3	115
7	1998.6.15	32	Arak-Path		12.0	113
8	1998.6.15	32	Arak-Path		12.3	115
9	1998.6.17	37	Pathfinder	Southern	20.0	113
10	1998.6.17	37	Pathfinder	Southern	22.4	113
11	1998.6.21	46	Pathfinder	Southern	24.7	113
12	1998.6.21	47	Pathfinder	Southern	25.3	112
13	1998.6.22	51	Pathfinder	Southern	26.0	114
14	1998.6.25	65	Pathfinder	Southern	17.0	114
15	1998.6.25	66	Pathfinder	Eastern	16.4	117
16	1998.6.25	66	Pathfinder	Eastern	15.3	112
17	1998.6.26	67	Pathfinder	Northen	17.0	112
18	1998.6.26	67	Pathfinder	Northen	6.1	112
19	1998.6.26	67	Pathfinder	Northen	15-17	-
20	1998.6.27	70	Arakane	Southern	22.0	113
21	1998.6.27	71	Arakane	Northen	15.3	116
22	1998.6.27	74	Pathfinder	Northen	18.6	114
23	1998.6.27	74	Pathfinder	Northen	17.0	115
24	1998.6.27	76	Pathfinder	Southern	16.3	114

TL: Total length, TM: Total myomere, Arak-Path: Area between Arakane and Pathfinder seamounts, Northern: Northern area of seamount, Southern: Southern area of seamount, Eastern: Eastern area of seamount, Wastern: Wastern area of seamount. No.19 specimen was damaged.

Artificial maturation of Japanese eel, *Anguilla japonica*

Tomoko Uto, Yuzuru Suzuki, Katsumi Aida, P. Mark Lokman

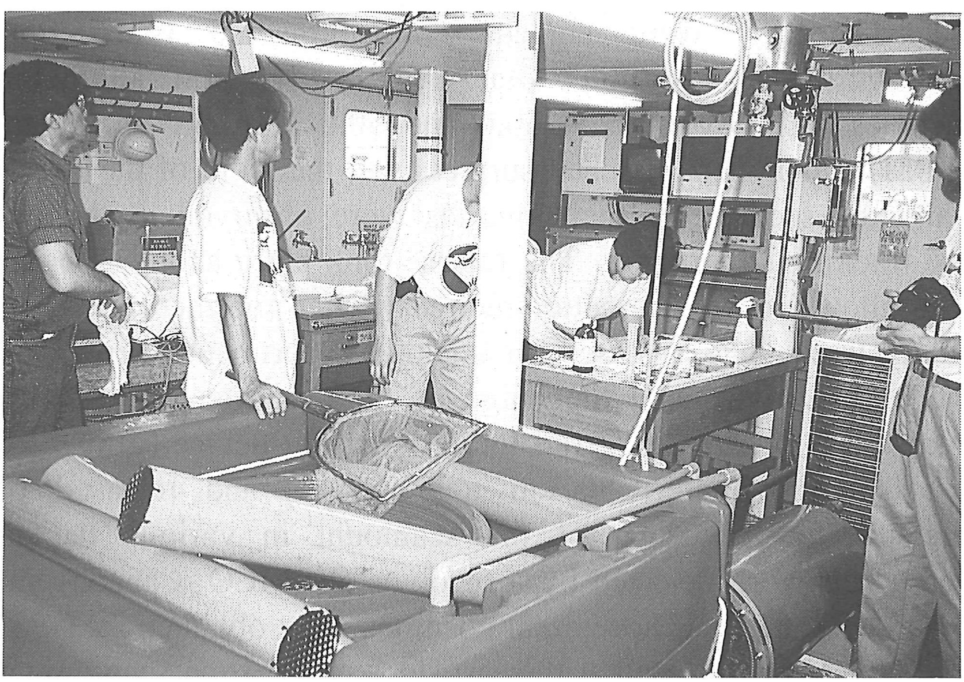
For the tracking and the adult eel sampling Japanese eels were artificially maturated by hormone injection during Hakuho Maru Cruise, which started from May 22 to July 2. Totally 101 eels were used.

Thirty three individuals of them (6 silver eels, 570－1300g in weight, and 27 feminized cultured eels, 450－840 in weight) were treated as female. The left ones (68 commercially cultured eels, 120－320g in weight) were treated as male. Silver eels were started to inject intramuscular salmon pituitary extract (SPE) once a week before the cruise (April 29－May 16) while the feminized eels were received injection of SPE just during this cruise. The males were started to inject intramuscular human chorionic gonadtropin (HCG) at a dose of 1000IU/kg BW once a week from April 27.

During the cruise, the females were received SPE once a week in May and twice a week in June, while the males were received HCG once a week in May and June (Table 1). All fish were kept in a 1m3 seawater tank at 22℃ and they were not fed. Hormone injection in Hakuho Maru were carried out satisfactorily. Two silver eels were induced to enter the final maturation phase in early June. These two fish were not used for the tracking and the adult eel sampling because the number was not enough. In order to get enough maturated fish around the new moon, the feminized eels were received SPE twice a week. Most of the fish were getting weak as the developing of gonad and could not reach the final maturation phase. Five feminized eels in the midvitellogenesis phase were used for the tracking. Most of the males had been spermiated from May 23 and three of them were used for the adult eel sampling. We succeeded to induce silver eels to ovulate and male eels to spermiate. It was very difficult to arrange the maturation timing of females and we couldn't get enough maturated fish for each investigation. Injection timing is necessary to be improved.

Table 1. Data and volume of injection in Hakuho Maru

	23 May	30 May	03 June	06 June	10 June	13 June	20 June
Female :SPE(mg/kgBW)	40	60	60	80	80	100	100
Male:HCG(IU/an individual)	1000	1000	-	1000	-	1000	1000



Tracking of hormone treated Japanese eel, *Anguilla japonica*, at seamounts as their estimated spawning sites.

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Hiroshi Hasumoto, Jurgen Schaure, Hans Fricke
and Katsumi Tsukamoto

In order to gain hints for emerging spawning migration of Japanese eel, *Anguilla japonica*, tracking experiments for artificially matured silver eels were carried out at their speculated spawning sites, on Arakane(15° 37.6N, 144° 5.8E) and Pathfinder (16° 30.0N, 143° 09.1E) seamounts(Fricke and Tsukamoto 1998).

The five female Japanese eels were weekly treated with a salmon pituitary extract, and kept in aerated tank which 23 degree of fresh surface sea water was continuously supplied during the cruise. The eels were tagged with ultrasonic transmitters (VEMCO/Canada, 48 mm total length, 16 mm diameter, frequencies 76.8, 69.0, 65.5, 60.0 and 50.0 kHz, pressure limit 1000 PSI) which were attached surgically to the front of the dorsal fin, and the sections of their ovaries were observed in the day before tracking experiment. The release took place about 12 hours later to allow tagged eels better recovery after anesthetization and handling stress. The eels used for tracking experiments were 550 - 850 g body weights and the range of their oocytes were 300 - 500mm. Eels were transferred into a releasing device (gray PVC tube, 10 cm diameter, 80 cm total length) and released by submersible at the slope of the seamount in various depths. Released eels were detected by a receiver (VEMCO /Canada) and followed by boat, their horizontal positions were obtained by GPS.

Eel No. 1 was released at the east slope of Arakane seamount at 324 m depth, 13.2 ℃ at 12:13 pm on 10 June 1998. Signal was lost just after releasing and not rediscovered.

Eel No. 2 was released at the east slope of Arakane seamount at 210 m depth at 9:17 am on 12 June 1998. Eel moved down for about 50 m just after releasing and moved up for about 160 m, then swam between 100 and 200 m depth. Minimum depth = 105 m, maximum depth 260 m, vertical depth range 155 m (Fig. 1). Its general horizontal swimming direction was south (Fig. 2). Signal was lost at 10:46 am in 186 m depth. Total tracking time was 89minutes.

Eel No. 3 was released at the east slope of Arakane seamount in 123 m depth, 24.4 ℃ at 9:17 am on 14 June 1998. Eel moved up for about 30 m immediately just after releasing and then swam between 32 and 123 m through a vertical depth range of 91 m (Fig. 1). Its general horizontal swimming direction was south (Fig. 2). Signal was lost at 12:18 pm (164 minutes after releasing). At 3:26 pm, signal was relocated and tracked for 9 minutes.

Eel No. 4 was released at the west slope of Pathfinder seamount, at 171 m depth at 9:17 am on 16 June 1998. Eel moved up for about 70 m immediately just after release and then swam between 80 and 120 m through a vertical depth range of 47 m (Fig. 1). Its general horizontal swimming direction was south (Fig. 2). Signal was lost after one hour in a distance of about 1200 m to the releasing position close to the reef.

Eel No. 5 was released at the east slope of Arakane seamount, at 215 m depth, 21.4℃ at 10:14 am on 18 June 1998. Eel moved up for about 30 m just after release and then swam between 100 and 200 m within a depth range of 157 m (Fig. 1). Tagged eel first moved to north, and about 3 hours later it went back southward closer to the reef but remained in open water (Fig. 2) . Tracking was abandoned at 5:19 pm as previously scheduled.

In the present study, under-water release of tagged fish using submersible was firstly carried out. Although the eels were briefly exposed to 30℃ in surface water, they were slowly brought to the waters of about 23℃ which they acclimatized more than 5 weeks. The effect of the under-water release by submersible is not clear with no comparable data. But we believe that it could be a releasing method to possibly alleviate environmental stress for tagged fish.

All tagged eels except eel No.3 moved horizontally offshore with leaving from the seamounts, although previously it was expected to remain on or around the seamounts as their estimated spawning sites. It is obvious that the eels used in the present study were not fully advanced in sexual maturation, with ranges of their oocytes diameter, 300 - 500 μm. It might be a reasons why the eels did not remain around the seamounts. Eel No. 3 exhibited unusual swimming behaviour with moving into shallow water at the top of the seamount, and showed strong zig-zag swimming. It was possibly captured by a sharks or a Caranx sp.which were abundantly observed from submersible at the releasing. Although our tracking experiments were considerably shorts, all tagged eels mainly moved in depths between 100 to 200 m with none of them moving into deep water. In consideration of the present study and the previous reports on spawning migration of the Atlantic eel species, A. anguilla and A. rostrata (Tesch 1989, Fricke and Kaese 1995) it is highly unlikely that spawning migration of anguillid eels in deep-water such as thousands of meters in depth as previously reported (Robins et al. 1979). The present study suggested that spawning migration of pre-matured silver eel migrate mid-water or subsurface. The long term tracking experiments for fully matured silver eels are required to provide further information about spawning migration of Japanese eels.

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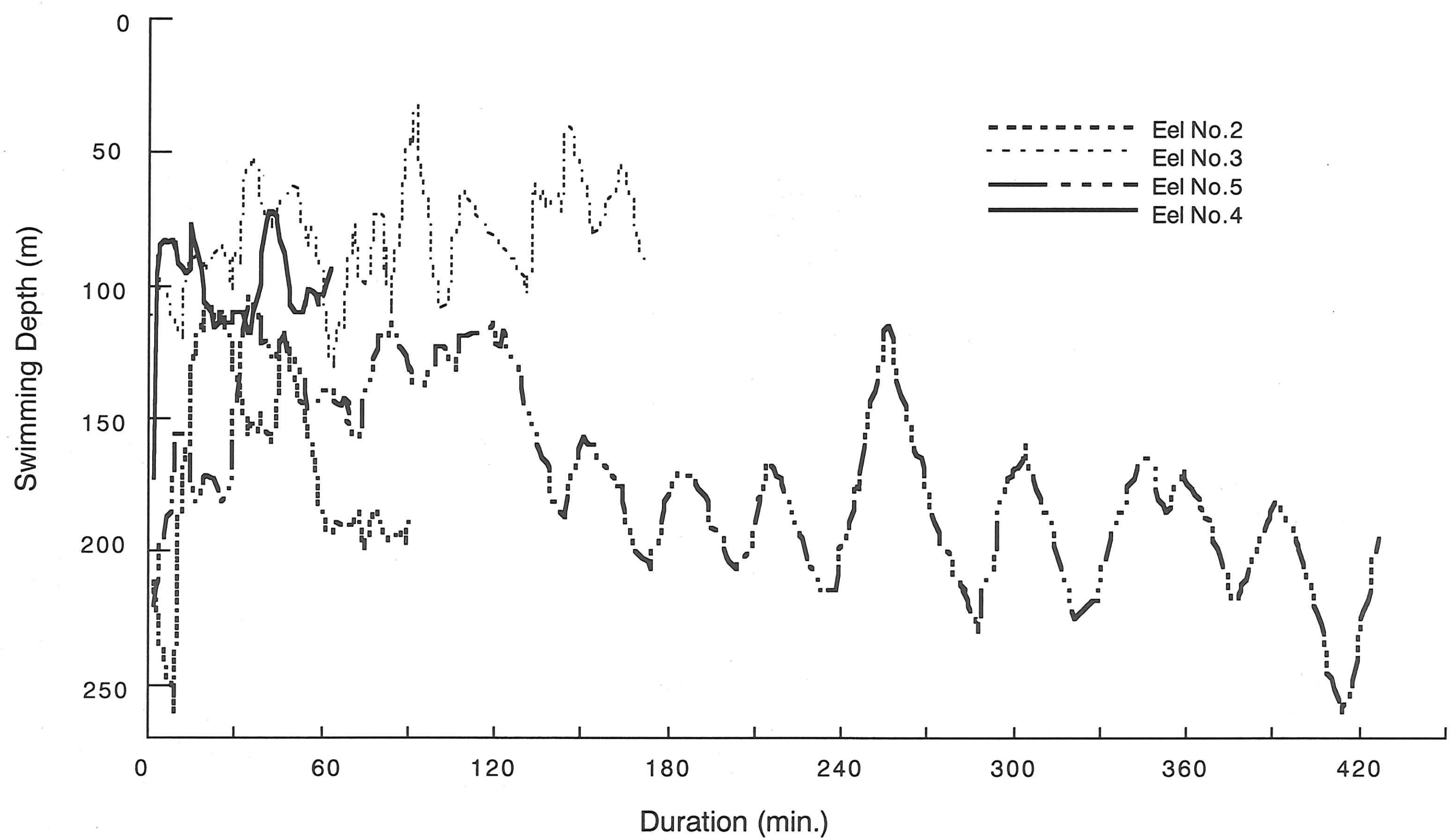

Fig.1 Swimming depth of four tagged Japanese eels.

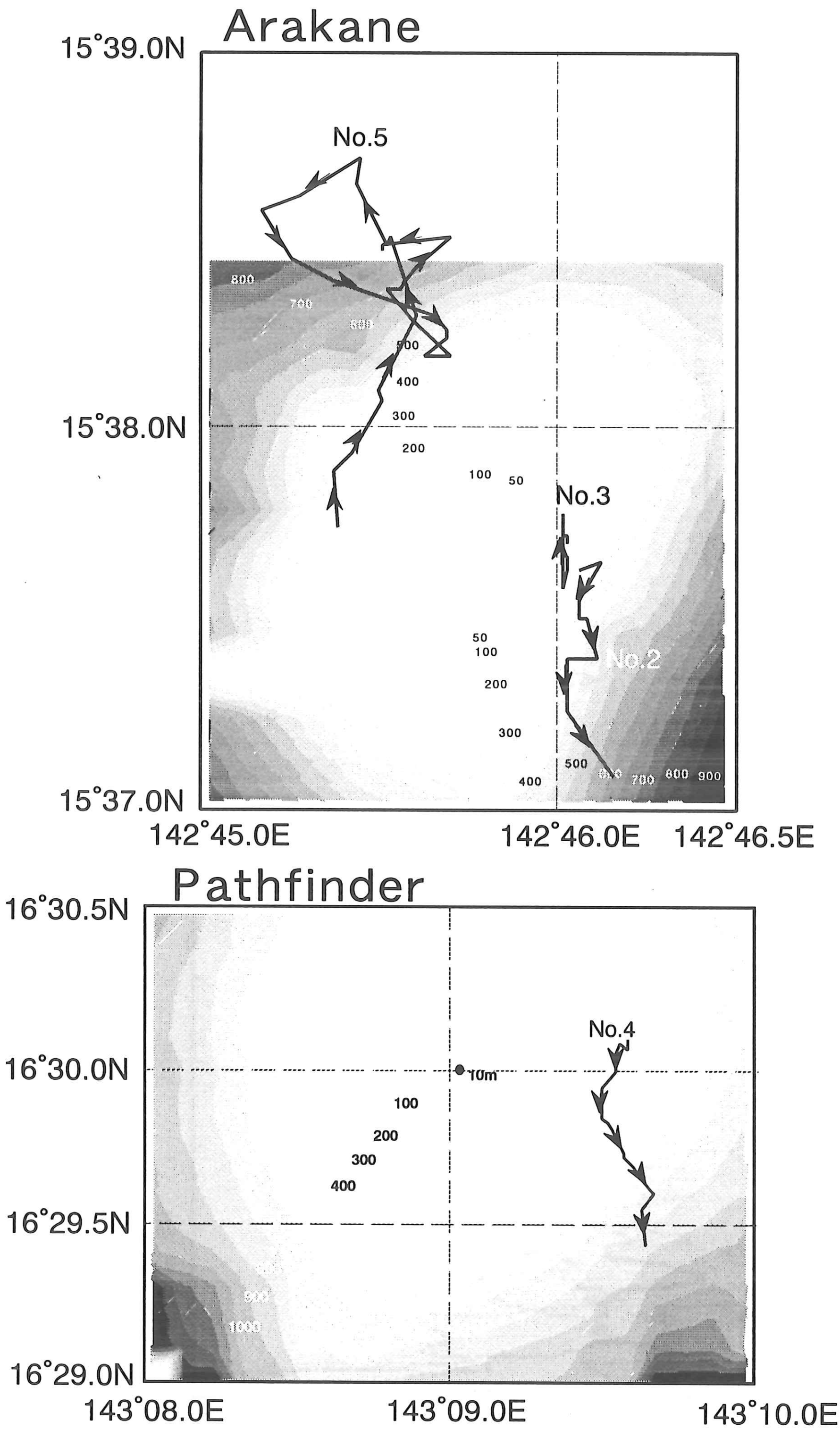

Fig.2 Directional swimming patterns of tagged eels released at the Arakane (above) and The Pathfinder (below) seamounts. The seamounts are presented bathymetrically based on previous data obtained by Suruga-Maru cruise in 1997

Anguilla marmorata leptocephali

Noritaka Mochioka, Tsuguo Otake, Satoshi Ishikawa,
Shun Watanabe, Machiko Oya, and Katsumi Tsukamoto

Two specimens of *Anguilla marmorata* leptocephali were collected during the cruise. Catalogue number, collection data, body size, myomere counts, and number of teeth of the leptocephali are shown in Table 1.

These leptocephali are characterized by having an olive leaf shape; normal eye; head and jaw suspension; simple straight gut without thickenings, loops or arches; absence of melanophores, except eye and at the tip of tail; anus near three-quarters body length. These characters fit the Anguillidae, only. [1] The larvae have 102 - 103 myomeres and nine ano-dorsal myomeres. This indicates that they belong to the long finned eel. The character, together with its locality, restricts the identification to *A. marmorata* Quoy et Gaimard.[2-5]

The specimen, 38.7 mm in total length (TL) was collected at the west side of Arakane reef by a horizontal tow of an IKPT(Issacs-Kidd Plankton Trawl) with 0.5 mm mesh aperture at a depth of 200 m. Another specimen, 24.6mm TL, was collected at the south side of Pathfinder reef by a oblique towing of an IKPT from the surface to a depth of 300 m.

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Table 1. Catalogue number, collection date, length of body, myomere count, and teeth of *Anguilla marmorata* leptocephali. TL, total length (mm); PAL, Preanal length (mm); PDL, Predorsal length (mm); BD, Body depth (mm); v.b.v., vertical bloodvessel; PDM, Predorsal myomeres; PAM, Preanal myomeres; TM, Total myomeres.

Fish No.	1	2
Date	1998/6/19	1998/6.21
St. No.	41	52
Gear	IKPT	IKPT
No.	1	1
TL	38.7	24.6
PAL	29.3	19.3
PDL	25.6	17.3
BD	8.5	5.2
1st v.b.v.	18	19
Last v.b.v.	45	45
PDM	61	64
PAM	71	74
TM	102	103
Teeth	1+1+6+6/1+8+4	1+1+3+4/1+4+4

Anguilliform and notacanthiform leptocephali

Noritaka Mochioka, Tsuguo Otake, Satoshi Ishikawa,
Shun Watanabe, Machiko Oya, and Katsumi Tsukamoto

A total of 448 leptocephali of various taxa were collected with gear types, including IKPT and ORI nets. The leptocephali were taken in 89 net sets during the cruise. The results aresummarized in Table 1.

All leptocephali belonged to the order Anguilliformes, except three specimen of the Notacanthiformes. The dominant families were Congridae (88 specimens, 19.6 %), Muraenidae (83 specimens, 18.5%), Derichthyidae (72 specimens, 16.1 %), and Serrivomeridae (65 specimens, 14.5 %). Leptocephali of the shelf family Congridae (*Congrinae* spp., *Heterocongrinae* spp., and *Ariosoma* spp.) and Muraenidae (*Gymnothorax* spp.) were abundant in the sea mount area. No leptocephali of the Nettastomatidae, Cyematidae, Eurypharyngidae caught in the cruise.

Table 1. Leptocephali collected at each station. Negative nets are omitted.
MG, Moringuidae; CH, Chlopsidae; MR, Muraenidae; NM, Nemichthyidae;
SY, Synaphobranchidae; OP, Ophichthidae; CG, Congridae; DR, Derichthyidae;
SR, Serrivomeridae; NC, Notacanthiformes; UI, Unidentified. A, Arakane;
P, Pathfinder. Obl, Oblique towing; Hor, Horizontal towing.

St. No.	Date	Reef	Position	Gear	Towing method	SY	MG	CG	OP	AN	MR	DR	SR	NM	CH	NC	UI	Total
3	980524			ORI-33	Obl. -1500m			1										1
4	980526			IKMT	Obl. -2500m			3	1				2					6
5				ORI	Surface						1			1				2
5				ORI	Surface			1						1				2
5				ORI-33	Obl. -200m			1				1	4					6
6	980527			ORI	Surface									1				1
6	980527			ORI	Surface			1						2				3
6				IKMT	Obl. -2500m			2										2
7				IKMT	Obl. -2500m								1					1
8				IKMT	Obl. -2500m								1					1
9				ORI	Surface						1			1				2
9				IKMT	Obl. -500m						2			1	1			4
10	980528			IKMT	Obl. -2500m							1						1
11				IKMT	Obl. -500m			1				1						2
12				ORI	Surface			1						1				2
12				IKMT	Obl. -2500m							1					1	2
13	980529			IKMT	Hor. -400m			2				2	3					7
16	980609	A	West	IKMT	Obl. -300m			3	1		5		1	1	1			12
16		A	West	IKMT	Hor. -300m			1	1		2		1					5
17		A	West	IKMT	Obl. -357m			2			1	1						4
17		A	West	IKMT	Hor. -150m			1					1					2
18		A	North	IKMT	Hor. -150m			4		1		1						6
19	980610	A	East	IKMT	Hor. -150m			1	1			1						3
20		A	South	IKMT	Hor. -150m			3		1			1					5
21	980610-11	A	West	ORI	Surface			1										1
21		A	West	IKMT	Hor. -150m						1		1	1				3
22	980611	A	West	IKMT	Hor. -60m			1		1	6							8
23		A	North	IKMT	Hor. -60m			4	1		4	1	3	3			1	17
24	980612	A	East	IKMT	Hor. -55m			1			3	1	2	2				9
25		A	South	IKMT	Hor. -55m						4		2	6	1			13
26	980613	A	East	IKMT	Obl. -wo. 2000m			1	1		2	2						6
27	980613	A	East	ORI	Surface				1									1
27	980613-14	A	East	IKMT	Hor. -100m			4	3		2							9
28	980614	A	South	IKMT	Hor. -100m			3			1	1			2			7
29		A	West	IKMT	Hor. -100m			3	1		1	2	1		2		2	12
30		A	North	IKMT	Hor. -100m			1			1			1	1		1	5
31	980615	A - P		IKMT	Step -150,100,70m			1	1		1		2	2			1	8
32		A - P		IKMT	Step -150,80,40m					5	4	1	1				1	12
33		A - P		IKMT	Step -150,100m							1	1					2
34	980616-17	P	West	IKMT	Hor. -150m			1	1		1	3			2		1	9
35	980617	P	North	IKMT	Hor. -150m							4	5		1			10
36		P	East	IKMT	Hor. -150m				2		1			1				4
37		P	South	IKMT	Hor. -150m		1	2	1	2	1	3	2		3			15
38	980618-19	A	North	IKMT	Hor. -200m							2						2
39	980619	A	East	IKMT	Hor. -200m			2					2	2				6
40		A	South	IKMT	Hor. -200m							2	2	2				6
41		A	West	IKMT	Hor. -200m					1	1	4	1	2				9

St. No.	Date	Reef	Position	Gear	Towing method	SY	MG	CG	OP	AN	MR	DR	SR	NM	CH	NC	UI	Total
42	980619-20	P	North	IKMT	Step -200,150,75m			5			6	2		2	2			17
43	980620	P	East	IKMT	Step -200,150,75m			1	1		3	4	1		1			11
44		P	South	ORI	Surface			1										1
44		P	South	IKMT	Step -200,150,75m							1						1
45		P	North	IKMT	Step -200,150,75m				1		1	1						3
46	980621	P	South	IKMT	Step -170,120,45m			1		1	1	2	2	1		1		9
47		P	West	IKMT	Step -160,100,60m			2	2	1	3	1	1	1			1	12
48		P	North	IKMT	Step -160,110,50m						2			1				3
49		P	East	IKMT	Step -170,120,75m										1			1
50	980622	P	North	IKMT	Obl. -300m			4			1			1				6
51		P	East	IKMT	Obl. -350m			1		1	1						1	4
52		P	South	IKMT	Obl. -300m	1				1	1		1				1	4
53		A	North	ORI	Surface			1										1
53		A	North	IKMT	Obl. -250m			2			2	1	1	3				9
54		A	West	IKMT	Obl. -250m						1		1					2
55	980622-23	A	South	IKMT	Obl. -250m			1				2	1					4
56	980623	A	West	IKMT	Obl. -250m			1			2	3	2		1			9
57	980623-24	P	South	IKMT	Obl. -500m			1	1			1					1	4
58	980624	P	North	ORI	Surface				1		1			1				3
58		P	North	IKMT	Obl. -500m			2					1	1				4
59		A	North	ORI	Surface				1									1
59		A	North	IKMT	Obl. -500m			2						1			1	4
60	980624-25	A	East	IKMT	Obl. -500m			1					1					2
61	980625	A	South	IKMT	Obl. -500m			1				3	2	3				9
62		P	East	IKMT	Obl. -300m						2	2						4
63		P	North	IKMT	Obl. -300m				1		1	1				1		4
64		P	West	IKMT	Obl. -300m							1						1
65		P	South	IKMT	Obl. -300m			2		1	1	1		1				6
66	980625-26	P	East	ORI	Surface			1										1
66	980626	P	East	IKMT	Step-300,225,150m					2	1	1						4
67		P	North	IKMT	Step-300,225,150m					3		2	1					6
68		P	West	IKMT	Obl. -300m			1				2	1	1	1			6
69	980627	A	West	IKMT	Obl. -300m			1	1		1	2	1					6
70		A	West	ORI	Surface			2										2
70		A	West	IKMT	Obl. -300m					1	2		1				2	6
71		A	North	IKMT	Obl. -300m					1	1		2					4
72		P	East	IKMT	Obl. -300m						3	1						4
73		P	North	IKMT	Obl. -300m							1						1
74		P	North	IKMT	Obl. -300m			1		2		1	2	1				7
75		P	East	IKMT	Obl. -300m		1						2					3
76		P	South	IKMT	Obl. -300m					1			1					2
77	980629			ORI	Obl. -2000m											1		1
Total						**1**	**2**	**88**	**25**	**26**	**83**	**72**	**65**	**49**	**20**	**3**	**15**	**448**

Shark aggregations on Arakane Seamount

Hans Fricke, Uwe Kohler, Gustav Hassenpflug, Mac Nagata
and Koji Fujii

During a RV Suruga Maru cruise in summer 1997, we recognized during the New Moon season on Arakane Seamount large aggregations of 4 different shark species: *Charcharinus galapagensis*, *C. plumbeus*, *C. melanopterus*, and *Triaenodon obesus*. The formation of large aggregations around New Moon could be due to mating events of the sharks but also to predation on spawning eels, possibly aggregating in huge masses. Because reef sharks do penetrate to depth of 200 m (and more) predation on spawning eels could be indeed expected. Both hypothesis were tested by visual observations and recordings of shark movements during different moon phases along deep water slopes.

We installed at the east side of the reef (Arakane Dream = a dive spot located by Mac Nagata) a permanent tripod at 32 m depth for long lasting video recordings. We recorded an identical deep water location (approx. 40-60 m depth) for a duration of 1 hour on successive days. In order to avoid influences of diurnal rhythms we choosed a constant time window between 14.30-16.00 pm.

We succeeded to perform a total of four 60 min recordings between June 14 and June 24 (New Moon), more recordings were not possible because of the tight time schedule of the JAGO dives. The number of sharks counted on the video increased on the day of New Moon. We observed among individually recognized sharks many newcomers not known by us from previous scuba dives. Also we recognized large bite marks on several females, a typical mating event among many charcharinid sharks. Furthermore we encountered several gravid Triaenodon females with heavily swollen abdomen. This led us to conclude that the increase in shark numbers is a possible New Moon related mating pattern of sharks rather than a predator aggregation focussed on spawning eels.

Fish larvae and juveniles collected during KH-98-2

Akihisa Torii and Hironori Katayama

The Cruise KH-98-2 was made around Mariana Ridge in the western North Pacific from May 22 to July 2. The sampling was made by IKPT net(Mesh size 0.5 or1.0mm) with the towing methods as follows: oblique,step and horizontal. A total of 73 tows of IKPT nets were made at 71 stations. Fish larvae and juveniles were collected abundantly. Until now , those of only at St.19(15° N,14° E),St.51(16° N,143° E) were identified, which are shown below.

Table. Species of epipelagic fishes collected at tow stations.

Family Gonostomatidae		
Diplophos taenia	*Benthosema. suborbitale*	*Opostomias mitsuii*
Vinciguerria attenuata	*Diogenichthys atlanticus*	*Melacosteus niger*
V. nimbaria	*Symboloyhorus evermanni*	*Lestidium atlanticum*
V. poweriae	*S. californiensis*	*Chaunacidae* sp.
Gonotoma gracile	*Centrobranchus nigroocellatus*	*Himantolophidae* sp.
G. elongatum	*C. andrea*	*Holocentridae* sp.
G. ebelingi	*Lampadena luminosa*	*Makaira mazara*
G. atlanticum	*Bolinichthys longipes*	*Lepidocybium flavobrunneum*
Cyclothone alba	*Lampanyctus regalis*	*Studis atrox*
C.pseudopallida	*Triphoturus microchir*	*Echeneididae* sp.
C. atraria	*Diaphus* A group	*Schindleriidae praematura*
C. pallida	*D.* B group	*Acanthuridae* spp.
Maurolicus muelleri		*Thalassoma sp*
	Others	*Labridae* spp.
Family Myctophidae	*Idiacanthus* sp.	*Scaridae* spp.
Hygophum proximum	*Argyropelecus* sp.	*Serranidae* spp.
H. reinhardtu	*Synodus variegatus*	*Gobiidae* spp.
H. orientale	*S. macrops*	*Scombridae* spp
Benthosema fibulatum	*Scopelosaurus* sp.	

Salpida collected in Arakane and Pathfinder Seamounts and an observation of the periodic reversal of the Salpid heart

Kaoru Kubokawa

Salpida were sorted out from plankton net samples collected by towing with the ORI and IKPT plankton nets in an sea area of the Arakane and Pathfinder sea mounts. The collection was originally planned to find eggs and leptocephali of *Anguilla japonica* (Ref. Otake et al. in this report). The ORI net was towed through a shallow water layer near the surface of the sea and the IKPT net was towed through a deep layer of 300-500 m from the sea surface. The towing was started at about 21:00 and ended about 04:00, although the towing time varied by day. Salpas were sorted visually with naked eyes and the number was counted. In samples of thirteen towings at Arakane and fifteen towings at Pathfinder, 597 and 89 salpas were found, respectively. Eight species of seven families were identified in the total of 686 salpas. For the identification of these species, the author owed much to Dr. Jun Nishikawa, Ocean Research Institute, University of Tokyo.

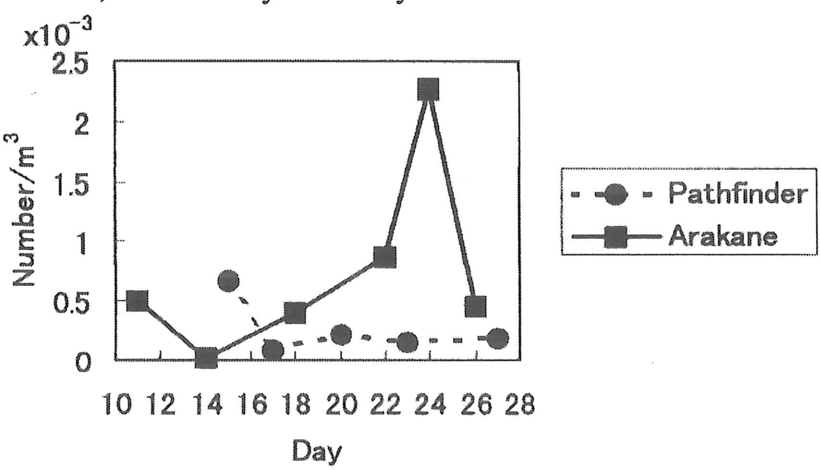


Fig.1. Daily numbers (per m^3 of filtered water) of salpas collected at Arakane and Pathfinder in KH-98-2 during a period from 10 to 26 June, 1998.

Table 1. Salpida collected in Arakane and Pathfinder seamounts

Species	Condition	Number of Specimen	
		Arakane	Pathfinder
Iasis zonaria	Aggregate, Solitary	0	2
Metcalfina hexagona	Aggregate, Solitary	2	0
Ritteriella amboinensis	Solitary	86	53
Ritteriella retracta	Solitary	7	0
Salpa aspera	Aggregate, Solitary	436	19
Salpa aspera	Solitary	28	0
Weelia cylindrica	Solitary	15	13
Pegea contoederata	Aggregate, Solitary	22	2
Pegea bicaudata	Aggregate	1	0

The most popular salpid species at Arakane was *Salpa aspera* and that at Pathfinder was *Ritteriella amboinensis*. The towing of the nets was conducted on 12, 14, 18, 22, 24 and 26 June at Arakane, and on 15, 17, 20, 23 and 27 June at Pathfinder. The number (per 1 m^3 of filtered water) of salpas larger than 5 mm in the body length increased slowly day by day from 14 June, and reached the maximum on 24 June, and then abruptly decreased on 26 June at Arakane (Fig. 1). At Pathfinder, the net samplings were not conducted between 23 and 27. Therefore, we failed to confirm that whether the peak of salpa synchronizes at Pathfinder or not. However, a huge number of *Salpa aspera* smaller than 5mm in the body length were collected on 27 and 28 June at Pathfinder. This suggests the presence of the peak of the number after 28 June, if the small salpas stay an area of net sampling in Pathfinder. The total number of salpa was generally larger at Arakane than at Pathfinder, although these small salpas were not included in the total number of salpa shown in Fig. 1.

The periodic reversal of the beating is one of characteristics of the heart activity in tunicates and salpas. Contraction of the heart muscle propagates peristatically towards the endostyle (advisceral direction) and then towards the intestine (abvisceral direction). A number of reports has been published on the electrophysiological analysis of the periodic reversal of the heart beating in ascidians but little in salpas (Ebara, 1954). The heart of the salpa is a simple tube-like structure, lacks valves, locates near the posterior end of the endostyle and is enclosed by the pericardium. The contraction of the heart starts from either one of two centres existing at both ends of the heart. We used ten uninjured salpas collected by plankton nets for observation of the heart beat. The number of individuals observed was 2 in *Weelia cylindrica*, 1 in *Iasis zonaria*, 3 in *Ritteriella amboinensis*, 1 in *Ritteriella retracta*, 2 in *Pegea confoederata*, and 1 in *Pegea bicaudata*. Each animal was put in a small (glass or plastic?) dish of 3cm in diameter containing seawater and observed under the binocular scope (Olympus SZX-12) equipped with the high speed video camera system (NAC MHS-200). The temperature of the seawater was maintained at about 26℃ by an air condition system.

The contraction wave starts from one end of the heart and extends to the other end. The beating in one centre continues for a while, then suddenly stops and after a short duration of the pause the beating in the other centre starts. The change in the direction was divided into two types according to species. In *Weelia*, *Iasis*, *Pegea* and *Salpa*, the heart beats are observed as mentioned above sentences (Fig. 2). In *Ritterie*, after finishing the beating in one direction, contraction waves start from both end of the heart toward the centres at the same time, strike at the centres and stop there. At the end of the pause the contraction wave of the inverse direction begins (Fig.2). The number of contraction waves in one direction and the duration of the beating in one direction vary among species (Table 2 and 3, Fig. 3 and 4).

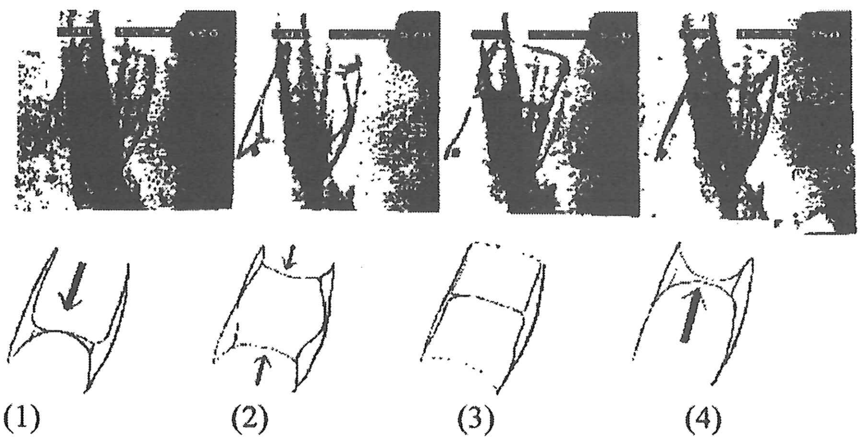


Fig.2. The video pictures (upper) and line drawings (lower) of the heart beat in *Ritteriella amboinensis*. (1) The last bear to one (abvisceral) direction (2) The contraction waves from both ends (3) Pause (4) The first beat to the opposite (advisceral) direction.

Table 2. The total number of contraction waves in one direction at one time. The numbers described in parentheses indicate minimum and maximum number.

	Direction of the wave movement		
Species	Abvisceral	Advisceral	Ratio (Ab/Ad)
Weelia cylindrica	4.4 (4-5)	5.0 (5-5)	0.88
	6.8 (3-10)	5.2 (5-6)	1.31
Iasis zonaria	98 (95-103)	94.5 (90-99)	1.04
Ritteriella amboinensis	10.4 (9-12)	16.1 (13-19)	0.65
	14.8 (14-16)	24.9 (21-28)	0.59
	24.8(22-26)	40.1 (37-43)	0.62
Ritteriella retracta	23.4 (19-27)	18 (14-24)	1.30
Pegea confoederata	3.5(22-25)	8.8 (8-9)	2.67
	22.3 (22-23)	11.2 (11-12)	1.99
Pegea bicaudata	39 (19-49)	60.5 (54-65)	0.64

Table 3. The number of the beat per a second in one direction. The numbers described in parentheses indicate minimum and maximum frequency.

	Time of the beating		
Species	Abvisceral	Abvisceral	Ratio (Ab/Ad)
Weelia cylindrica	1.42 (1.39-1.44)	1.40 (1.34-1.44)	1.01
	1.70 (1.32-1.85)	1.89 (1.66-1.78)	0.90
Iasis zonaria	0.72 (0.71-0.73)	0.72 (0.70-0.75)	1.00
Ritteriella amboinensis	0.68 (0.65-0.70)	0.77 (0.76-0.79)	0.88
	0.73 (0.72-0.75)	0.82 (0.80-0.84)	0.89
	0.80 (0.77-0.92)	0.79 (0.89-0.93)	1.01
Ritteriella retracta	0.79 (0.76-0.81)	0.70 (0.66-0.73)	1.13
Pegea confoederata	1.33 (1.32-1.36)	1.05 (1.05-1.04)	1.27
	1.26 (1.22-1.35)	0.97 (0.92-1.07)	1.29
Pegea bicaudata	1.08 (1.07-1.10)	1.25 (1.24-1.26)	0.86

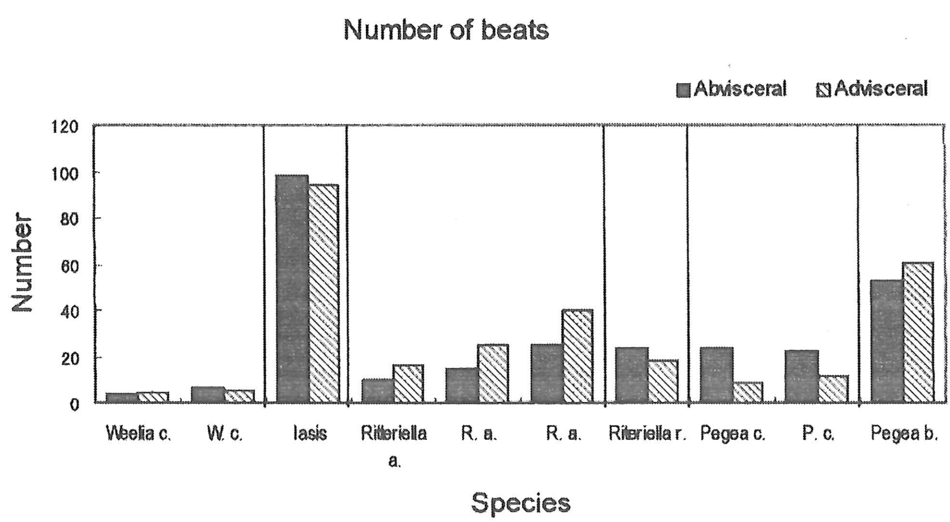


Fig.3. The number of heart beat in salpas observed at Hakuho Maru in KH-98-2. The number is shown as an average of the number of heart beat in the direction of abvisceral or advisceral in individual salpa.

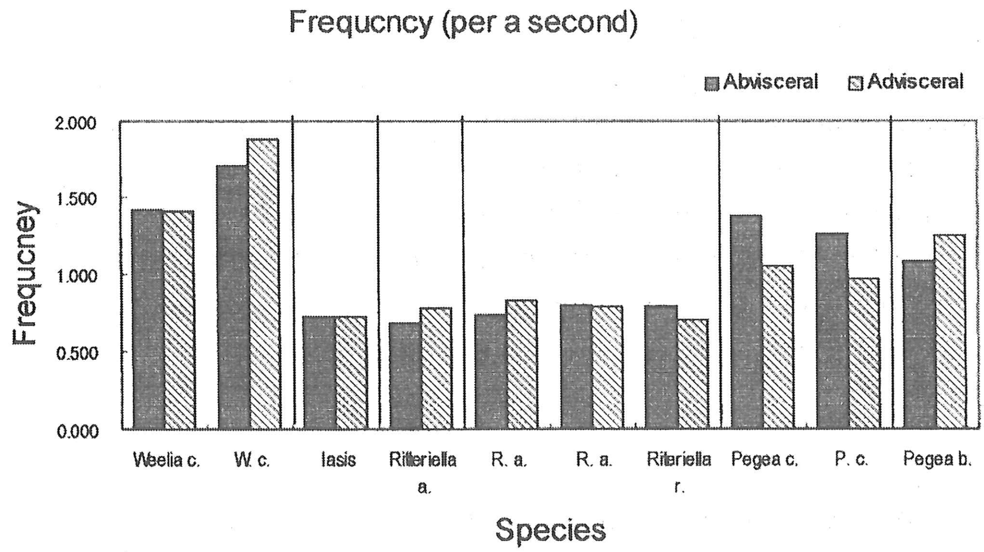


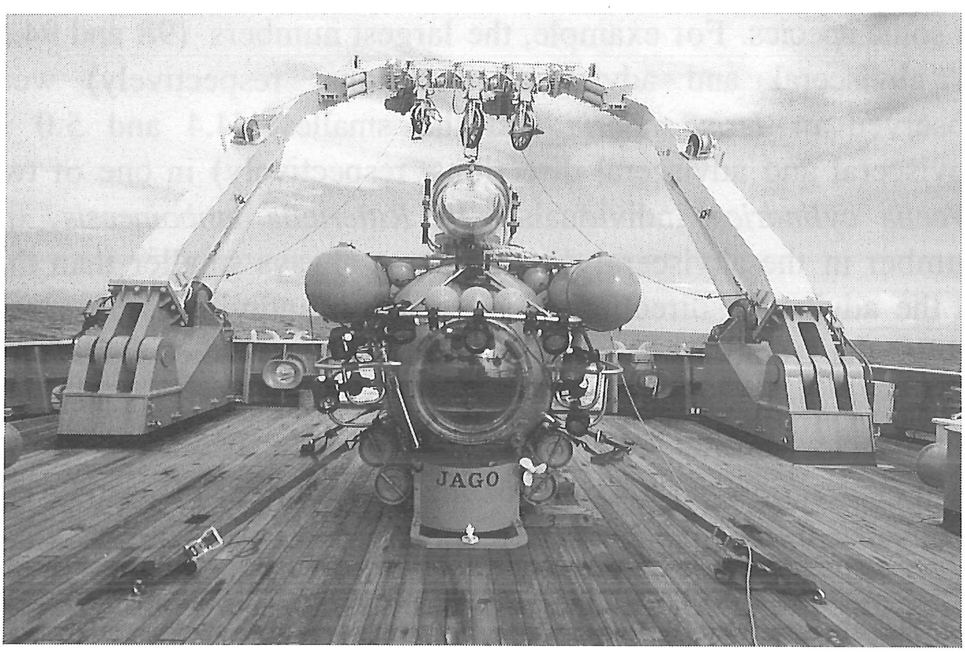
Fig.4. The number of heart beat per a second in salpas observed at Hakuho Maru in KH-98-2. The frequency is shown as an average of number of heart beat per a second in the direction of abvisceral or advisceral in individual salpa.

The number of a series of contractions in one direction varied largely among species and also between the two directions in some species. For example, the largest numbers (98 and 94.5, in abvisceral and advisceral directions, respectively) were observed in *Iasis zonaria* and the smallest (4.4 and 5.0 in abvisceral and advisceral directions, respectively) in one of two *Weelia cylindrica* individuals. In *Ritteriella amboinensis*, the number in the abvisceral direction was always smaller than that in the advisceral direction in all the three individuals observed, while the relation was reversed in both of the two *Pegea confoederata* individuals observed. In the other species, the number was similar between two directions. The frequency of each contraction per a second or the total number of beating in a series of contractions in one direction varied in a relatively small range among species. Individual difference within a species and the difference between the two directions were also small. The difference in the duration seems to be related to the family of the animal, since amboinensis and retracta which belong to *Ritteriella* and contoederata and bicaudata which belong to *Pegea* showed similar duration values.

The author proposes a hypothesis for the reason why tunicates and salpas possess such a periodic reversal system in their heart. A periodic reversal of the heart beat would be necessary for the even distribution of the blood to all the organs. One centre of generating the contraction wave has a resting state during the period of the continued beating of the other centre. However, the mechanism of the periodic reversal has not been revealed yet.

Reference

Ebara, A. (1954) The periodic reversal of the heart-beat in Salpa fusiformis. *Science Reports of the Tokyo Bunrika Daigaku*, **7**, (110-111), 199-210.



Biodiversity of Arakane, Pathfinder and Stingray Seamount between 100-400 m depth

Hans Fricke, Juergen Schauer, Karen Hissmann, Tadashi Inagaki, Katsumi Tsukamoto, Jun Aoyama and Satoshi Ishikawa

The intermediate depth of the worlds ocean between photic and aphotic depth is the least known marine biota. The AGENDA 2000 of the UNESCO focuses on a worldwide establishment of the existing faunistic diversity throughout all existing habitats. Our eel expedition provided a unique chance to explore the marine diversity within the depth capacity of JAGO between 100-400 m depth along the slope of 3 remote seamounts (SM) in the Western Pacific.

We applied video techniques and recorded continuous transects of the visual macrofauna, detailed close-up photography and performed small reference collections for later systematic studies and species identification. The submersible was equipped with two parallel laser beams projecting a distance of 50 cm on the seafloor. This measurement allows quantitative assessment of species abundances and population densities. The laser points were videotaped from inside of the submersible with the help of a Sony Digital camera VX 1000, detailed close-ups were obtained with a camera head mounted outside on the submersible's manipulator arm and recorded on Betacam SP.

Five continuous transects covered the steep slopes of Arakane and Pathfinder SM, one transect on Stingray SM between 70 and 400 m depth. The transects provide a first quantitative assessment of the major faunal components of this remote SMs. We discovered a unique sponge zone between 200 and 240 m depth along all slopes of the three SMs. Reef building symbiotic corals (*Leptoseris* sp) occurred down to 188 m far below the hitherto known limits of coral growth and coral photosynthesis. Photosynthesizing coralline algae were discovered down to exceptional 280 m depth. Also we encountered for the first time long-stalked crinoids, isocrinid sea lilies which are mainly known from very deep water or even the Deep Sea.

Our surveys will provide a first insight in the ecology ofshallow seamounts of the open ocean exposed to the destructive forces of Taifuns in the Western Pacific. The analysis of the videotaped material will be made available in the internet.

Distribution of currents around Arakane, Pathfinder and Stingray Seamounts

Hiroshi Hasumoto and Tadasi Inagaki

During the cruise (KH-98-2 Leg.2) of the research vessel Hakuho Maru, we have conducted measurements of the North Equatorial Current using a 38 kHz broadband phased array Acoustic Doppler Current Profilers (ADCP RD Instruments).

From these measurements, we have obtained current velocity data from around Arakane, Pathfinder and Stingray seamounts. Measurements were made at 32.4, 112.4 and 208.4 m layers at intervals of 2 or 3 miles at each sea mount.

Arakane Seamount. (15° 38'N, 142° 45'E) (Fig.1)

At the North side of Arakane seamount, the currents were almost westward and velocities were between 0.1 to 1.3 knots. At the west side, currents were flowing almost southward and at low latitude stations, currents were southwestward and velocities were between 0.1 to 2 knots. On the south side, current velocities were weak and their directions were not uniform. On the east side, currents were almost west or west-south westward flows and the velocities were between 0.5 to 1 knots.

Based on these observations, it is suggested that current flows from east to west around the sea mount, and there is a counterclockwise current on top of the seamount.

Pathfinder Seamount. (16° 32'N, 143° 08'E) (Fig.2)

On the north side of Pathfinder seamount, currents were almost south and south-eastward and the velocities were between 0.5 to 1.7 knots. On the west side, currents were almost south-eastward and the velocities were between 0.5 to 1.7 knots. On the south side, currents were almost south and east-south-eastward and the velocities were from 0.3 to 2.0 knots. On the east side, currents were almost north and north-eastward and the velocities were higher than other areas at 0.3 to over 2.0 knots.

These observations show that this area is strongly influenced by the North Equatorial Counter Current or by an eddy made by the Counter Current.

Stingray Seamount. (20° 29'N, 142° 27'E) (Fig.3)

On the north side of Stingray seamount, currents were almost west and south-westward flows and the velocities were between 0.7 to more than 2.0 knots. On the west side, currents were almost south and south-eastward and the velocities were between 1.0 to 2.2 knots. On the south side, currents were almost south and east south-eastward and the velocities were 0.3 to about 2.0 knots. On the east side, currents were almost north and north-eastward and the velocities are 0.5 to more than 2.0 knots.

These observations show that the current around Stingray Seamount is similar in pattern to the Pathfinder Seamount, and showed strong flows 208.4m layer on the east side.

Our observations show the complicated nature of currents in both direction and velocity around sea mounts.

Fig.1 In the directions and velocities of currents at 32.4, 112.4 and 208.4m layers in Arakane seamount.

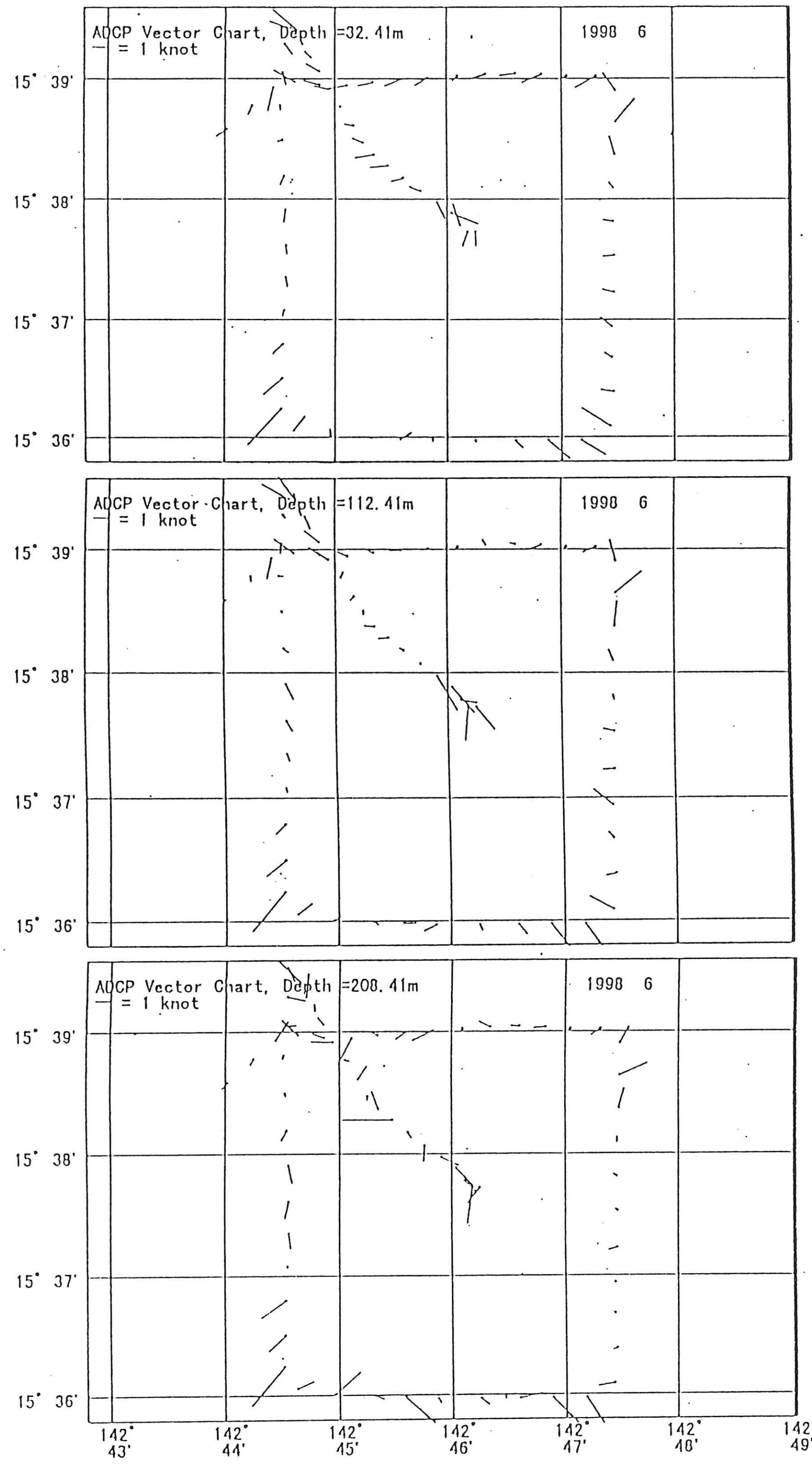


Fig.2 In the directions and velocities of currents at 32.4, 112.4 and 208.4m layers in Pathfinder seamount.

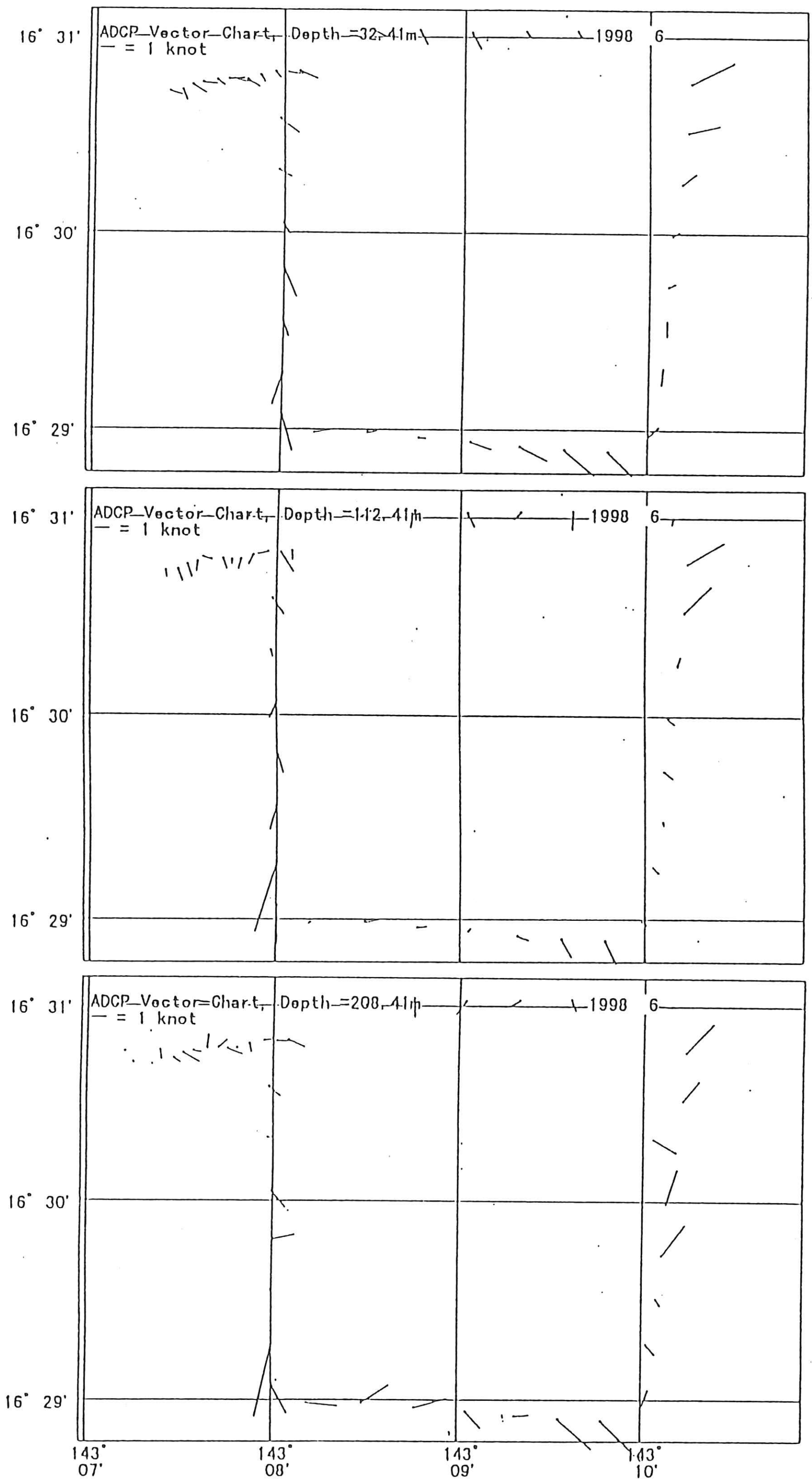
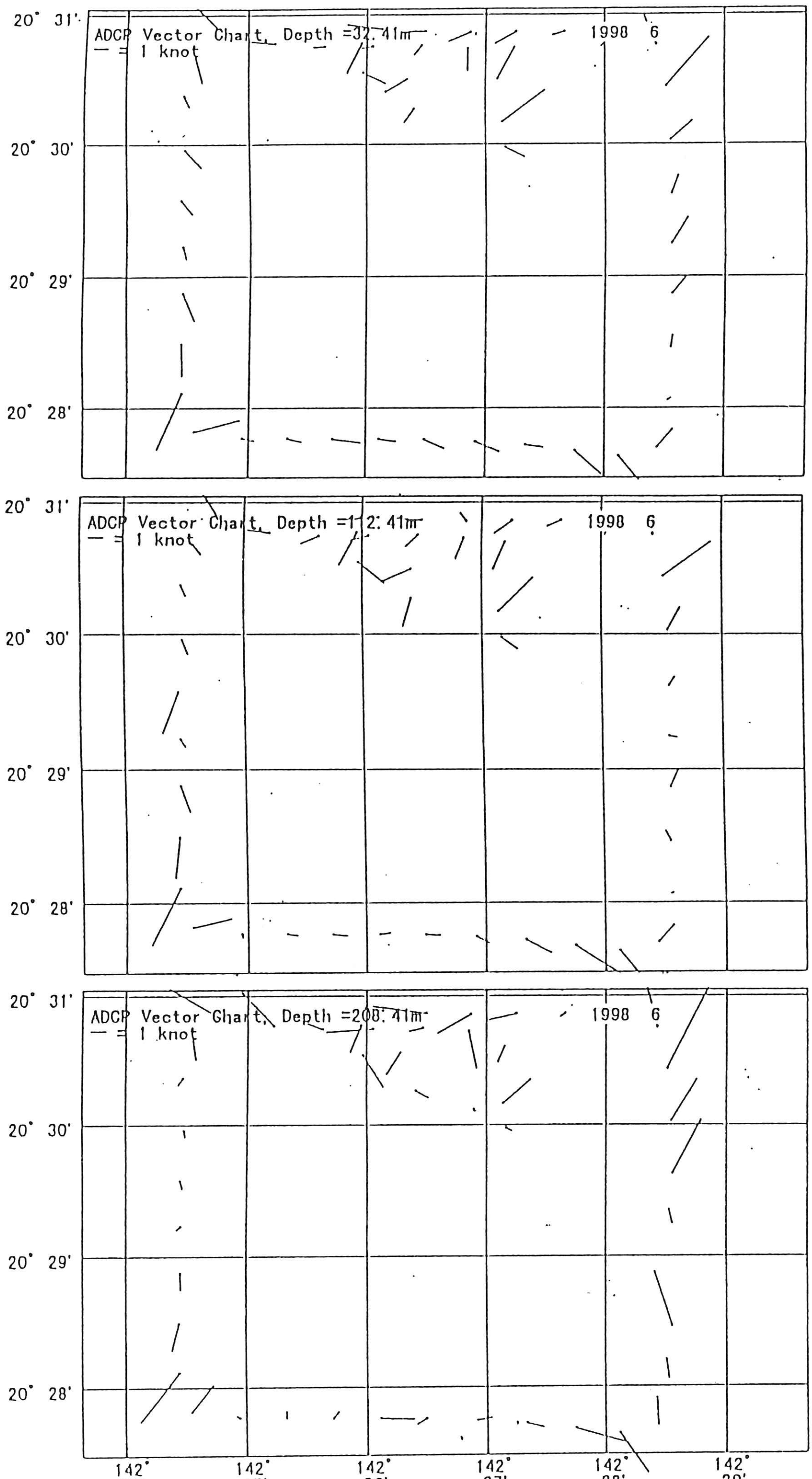


Fig.3 In the directions and velocities of currents at 32.4, 112.4 and 208.4m layers In Stingray seamount.



Ⅵ. Net record

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
2	30-01.8	30-02.3	980524	08:12	09:40	ORI	0.33	Hor.	1200	0-1168		1.0	5760
	142-51.9	142-52.9											
2	30-01.9	30-02.1	980524	08:45	09:13	ORI	0.69	Surf.				1.0	2107
	142-52.2	142-52.7											
3	27-29.9	27-28.8	980524	21:12	22:55	ORI	0.33	Hor.	1500	0-1389		1.0	5948
	143-49.9	143-49.9											
3	27-29.7	27-29.6	980524	21:26	21:37	ORI	0.69	Surf.				1.0	368
	143-49.9	143-49.9											
3	27-29.4	27-29.1	980524	22:54	23:14	ORI	0.69	Surf.				1.0	1459
	143-49.9	143-50.0											
4	25-00.5	24-56.6	980526	00:27	02:38	IKMT	1.0	Obl.	2500	—		-	57446
	142-32.2	143-30.6											
4	25-00.2	24-59.4	980526	00:36	00:56	ORI	0.69	Surf.				-	1743
	143-32.2	143-31.9											
5	22-00.1	21-56.8	980526	18:22	20:14	ORI	0.33	Hor.	2000	0-913	0.5-1.0	2.0-1.5	12235
	142-03.2	142-05.6											
5	21-59.5	21-58.7	980526	18:36	18:56	ORI	0.69	Surf.				2.0	2407
	142-03.4	142-03.9											
5	21-58.5	21-57.8	980526	19:02	19:22	ORI	0.69	Surf.				1.5	2356

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
	142-04.1	142-04.6											
6	20-59.5	20-55.8	980527	00:18	01:54	IKMT	1.0	Obl.	2500	0-815		2.5-1.0	44776
	141-59.9	141-59.7											
6	20-59.4	20-58.5	980527	00:22	00:42	ORI	0.69	Surf.				2.5	4596
	141-59.9	142-00.0											
6	20-58.3	20-57.2	980527	00:47	01:07	ORI	0.69	Surf.				2.5	3190
	141-59.9	141-00.0											
7	20-00.3	19-58.6	980527	06:53	08:32	IKMT	1.0	Obl.	2500	0-1107		2.5-1.0	30600
	141-58.7	141-59.2											
7	20-00.1	19-59.5	980527	06:57	07:17	ORI	0.69	Surf.				2.5	2918
	141-58.7	141-58.8											
7	19-59.2	19-58.7	980527	07:25	07:45	ORI	0.69	Surf.				2.5	2764
	141-58.9	141-59.2											
8	19-00.1	18-58.9	980527	13:45	15:19	IKMT	0.5	Obl.	2500	0-842	1.0	2.5-1.5	45309
	142-00.6	142-03.9											
8	19-00.1	18-59.7	980527	13:50	14:10	ORI	0.69	Surf.				2.5	3144
	142-00.7	142-01.7											
9	17-56.8	17-56.3	980528	01:45	02:18	IKMT	0.5	Obl.	500	0-163	1.0-0.5	2.5-1.0	11248
	141-58.4	141-59.1											

Time is indicated in SMT

KH98-2 Net Record

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m^3)
9	17-56.7	17-56.2	980528	01:49	02:19	ORI	0.69	Surf.				2.5	2945
	141-58.5	141-59.1											
10	16-59.8	16-59.9	980528	07:36	09:09	IKMT	0.5	Obl.	2500	0-944	1.0-0.5	3.0-1.5	40597
	141-59.0	142-01.7											
10	16-59.7	16-59.8	980528	08:19	08:39	ORI	0.69	Surf.				1.5	3611
	142-00.8	142-01.2											
10	16-59.8	16-59.9	980528	08:48	09:14	ORI	0.69	Surf.				1.5	1925
	142-01.4	142-01.7											
10	16-59.9	17-00.2	980528	09:34	11:25	ORI	0.33	Obl.	2000	0-1556	1.0-0.5	2.0-1.5	9037
	142-02.5	142-04.6											
11	16-00.5	16-00.9	980528	17:55	18:20	IKMT	0.5	Obl.	500	–	1.0-0.5	2.5-1.0	10459
	141-57.4	141-56.8											
11	16-00.6	16-00.9	980528	17:56	18:16	ORI	0.69	Surf.				2.5	2158
	141-57.3	141-56.8											
11	16-01.1	16-01.3	980528	18:36	18:56	ORI	0.69	Surf.				1.0	2117
	141-57.0	141-57.9											
11	16-01.1	16-01.4	980528	18:33	19:02	IKMT	0.5	Obl.	500	–	0.9-0.5	2.5-1.0	13381
	141-56.9	141-58.1											
12	15-00.1	15-02.9	980528	23:48	01:21	IKMT	0.5	Obl.	2500	0-725		2.5-1.0	54930

Time is indicated in SMT

KH98-2 Net Record

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m³)
	142-00.2	142-03.3											
12	15-00.2	15-00.8	980528	23:52	00:12	ORI	0.69	Surf.				1.0	3355
	142-00.4	142-01.5											
12	15-00.9	15-01.4	980529	00:16	00:36	ORI	0.69	Surf.				1.0	3153
	142-01.6	142-02.6											
13	14-00.9	14-00.8	980529	12:06	12:50	IKMT	0.5	Obl.	400	0-150	0.7-0.5	2.5-1.0	16297
	141-59.4	142-00.7											
13	14-01.0	14-00.8	980529	12:12	12:42	ORI	0.69	Surf.				2.5	4572
	141-59.5	142-00.7											
14	11-20.4	11-20.8	980530	22:46	23:28	VMPS	GG54	Vart.		1000,800,	1.0	-	-
	142-35.2	142-34.8								600,400,200			
14	11-20.9	11-21.4	980530	23:48	00:29	VMPS	GG54	Vart.		1000,800,	1.0	-	-
	142-34.6	142-34.3								600,400,200			
15	14-01.3	14-01.9	980601	10:14	12:02	ORI	0.33	Obl.		0-1202		-	-
	146-59.4	147-01.8											
15	14-01.3	14-01.6	980601	10:22	10:43	ORI	0.69	Surf.				-	-
	146-59.6	147-00.2											
16	15-38.9	15-38.9	980609	19:52	20:27	IKMT	0.5	Obl.	619	0-312	1.0-0.5	2.0	12957
	142-20.2	142-20.2											

Time is indicated in SMT

KH98-2 Net Record

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m^3)
16	15-38.5 142-14.5	15-38.8 142-14.9	980609	19:55	20:15	ORI	0.69	Surf.				2.0	2113
16	15-38.9 142-20.2	15-39.6 142-16.5	980609	20:34	21:15	IKMT	0.5	Hor.	335	0-151	1.0-0.5	2.0	14754
16	15-38.9 142-20.2	15-39.3 142-16.0	980609	20:36	20:56	ORI	0.69	Surf.				2.0	2322
17	15-37.5 142-39.0	15-37.9 142-40.5	980609	22:23	23:13	IKMT	0.5	Obl.	870	0-343	1.0-0.5	2.0	23549
17	15-37.5 142-39.1	15-37.8 142-39.6	980609	22:25	22:45	ORI	0.69	Surf.				2.0	2627
17	15-37.9 142-40.8	15-38.0 142-42.0	980609	23:20	00:05	IKMT	0.5	Hor.	449	0-162	1.0-0.5	2.0	26243
17	15-37.9 142-40.9	15-37.9 142-41.0	980609	23:22	23:42	ORI	0.69	Surf.				2.0	2607
18	15-38.9 142-45.2	15-38.2 142-46.9	980610	20:13	21:04	IKMT	0.5	Hor.	466	0-161	1.0-0.5	2.0	24826
18	15-39.9 142-45.3		980610	20:13	20:33	ORI	0.69	Surf.				2.0	2289
19	15-38.1	15-36.1	980610	21:11	22:06	IKMT	0.5	Hor.	459	0-163	1.0-0.5	2.0	24175

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size	Method	out	layer	speed	speed	volume
							(mm)		(m)	(m)	(m/s)	(kt)	(m^3)
	142-47.1	142-47.0											
19	15-38.0	15-37.3	980610	21:11	21:31	ORI	0.69	Surf.				2.0	2413
	142-47.1	142-47.0											
20	15-36.4	15-36.4	980610	22:22	23:23	IKMT	0.5	Hor.	580	0-167	1.0-0.5	2.0	30810
	142-46.3	142-43.8											
20	15-36.4	15-36.4	980610	22:23	22:43	ORI	0.69	Surf.				2.0	2321
	142-46.2	142-45.4											
21	15-37.3	15-39.2	980610	23:43	00:44	IKMT	0.5	Hor.	480	0-168	1.0-0.5	2.0	27816
	142-44.4	142.44-0											
21	15-37.4	15-38.0	980610	23:45	00:05	ORI	0.69	Surf.				2.0	2028
	142-44.4	142-44.3											
22	15-37.2	15-38.8	980611	22:06	22:58	IKMT	0.5	Hor.	239	*0-68	1.0-0.5	2.0	24610
	142-44.5	142-44.4											
22	15-37.3	15-37.9	980611	22:10	22:30	ORI	0.69	Surf.				2.0	2242
	142-44.5	142-44.4											
23	15-38.9	15-38.9	980611	23:13	24:00	IKMT	0.5	Hor.	240	*0-67	1.0-0.5	2.0	21989
	142-45.1	142-46.4											
23	15-38.9	15-39.0	980611	23:15	23:35	ORI	0.69	Surf.				2.0	2303
	142-45.2	142-45.7											

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
24	15-38.2	15-36.8	980612	00:20	01:04	IKMT	0.5	Hor.	215	*0-60	1.0-0.5	2.0	18488
	142-47.0	142-46.9											
24	15-38.1	15-37.5	980612	00:21	00:41	ORI	0.69	Surf.				2.0	2157
	142-47.0	142-46.9											
25	15-36.4	15-36.4	980612	01:19	02:05	IKMT	0.5	Hor.	219	*0-65	1.0-0.5	2.0	18211
	142-46.2	142-44.1											
25	15-37.0		980612	01:21	01:41	ORI	0.69	Surf.				2.0	1854
	142-46.0												
26	15-36.1	15-40.2	980613	07:57	09:42	IKMT	0.5	Obl.	2000	0-583	1.0-0.5	3.0-2.0	54917
	142-30.0	142-28.2											
27	15-38.0	15-36.3	980613	23:22	24:15	IKMT	0.5	Hor.	329	*0-108	1.0-0.5	2.0	22792
	142-47.0	142-47.2											
27	15-37.9	15-37.2	980613	23:27	23:47	ORI	0.69	Surf.				2.0	2322
	142-47.0	142-47.1											
28	15-36.5	15-36.7	980614	00:34	01:24	IKMT	0.5	Hor.	277	*0-104	1.0-0.5	2.0	18463
	142-46.2	142-44.2											
28	15-36.5	15-36.6	980614	00:36	00:56	ORI	0.69	Surf.				2.0	2203
	142-46.0	142-45.3											
29	15-37.3	15-39.1	980614	01:40	02:28	IKMT	0.5	Hor.	324	*0-108	1.0-0.5	2.0	26337

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
	142-44.4	142-44.2											
29	15-37.3	15-38.0	980614	01:41	02:01	ORI	0.69	Surf.				2.0	1752
	142-44.4	142-44.3											
30	15-39.0	15-39.0	980614	02:49	03:40	IKMT	0.5	Hor.	331	*0-112	1.0-0.5	2.0	20169
	142-45.1	142-46.2											
30	15-39.0	15-39.0	980614	02:51	03:11	ORI	0.69	Surf.				2.0	2159
	142-45.2	142-45.6											
31	15-51.1	15-51.6	980615	01:30	02:50	IKMT	0.5	Step	469	0-165	1.0-0.5	2.0	35734
	143-15.9	143-17.2											
31	15-51.1	15-51.2	980615	01:33	01:53	ORI	0.69	Surf.				2.0	2364
	143-14.9	143-15.5											
32	16-04.1	16-04.4	980615	04:13	05:25	IKMT	0.5	Step	531	0-161	1.0-0.5	2.0	35350
	143-14.9	143-17.1											
32	16-04.1	16-04.2	980615	04:15	04:35	ORI	0.69	Surf.				2.0	2552
	143-14.9	143-15.6											
33	16-17.6	16-17.7	980615	06:49	07:43	IKMT	0.5	Step	444	0-158	1.0-0.5	2.0	24111
	143-14.8	143-16.7											
33	16-17.6	16-17.7	980615	06:51	07:11	ORI	0.69	Surf.				2.0	2526
	143-14.8	143-15.6											

Time is indicated in SMT

KH98-2　Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
34	16-29.5	16-31.8	980616	23:21	24:21	IKMT	0.5	Hor.	478	0-161	1.0-0.5	2.0	27552
	143-08.2	143-07.8											
34	16-29.5	16-30.3	980616	23:23	23:43	ORI	0.69	Surf.				2.0	2110
	143-08.1	143-08.0											
35	16-30.7	16-30.7	980617	00:53	01:57	IKMT	0.5	Hor.	522	0-161	1.0-0.5	2.0	30033
	143-08.6	143-11.2											
35	16-30.7	16-30.7	980617	00:54	01:14	ORI	0.69	Surf.				2.0	2292
	143-08.6	143-09.5											
36	16-30.6	16-28.5	980617	02:24	03:26	IKMT	0.5	Hor.	457	0-152	1.0-0.5	2.0	26344
	143-10.0	143-10.3											
36	16-30.5	16-29.9	980617	02:26	02:46	ORI	0.69	Surf.				2.0	2354
	143-10.0	143-10.1											
37	16-29.2	16-29.1	980617	03:52	04:56	IKMT	0.5	Hor.	500	0-160	1.0-0.5	2.0	28573
	143-09.6	143-07.5											
37	16-29.2	16-29.2	980617	03:55	04:15	ORI	0.69	Surf.				2.0	2095
	143-09.5	143-08.8											
38	15-38.9	15-38.9	980618	23:31	00:26	IKMT	0.5	Hor.	600	0-211	1.0-0.5	2.0	24072
	142-45.1	142-46.6											
38	15-38.9	15-38.9	980618	23:34	23:54	ORI	0.69	Surf.				2.0	2491

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
	142-45.2	142-45.7											
39	15-38.2	15-36.2	980619	00:42	01:47	IKMT	0.5	Hor.	593	0-207	1.0-0.5	2.0	26775
	142-47.0	142-47.0											
39	15-38.2	15-37.6	980619	00:44	01:04	ORI	0.69	Surf.				2.0	2375
	142-47.0	142-47.0											
40	15-36.5	15-36.6	980619	02:08	03:07	IKMT	0.5	Hor.	659	0-209	1.0-0.5	2.0	26267
	142-46.3	142-43.7											
40	15-36.5	15-36.6	980619	02:10	02:30	ORI	0.69	Surf.				2.0	2381
	142-46.2	142-45.3											
41	15-37.3	15-39.5	980619	03:32	04:40	IKMT	0.5	Hor.	702	0-209	1.0-0.5	2.0	32206
	142-44.4	142-43.2											
41	15-37.3	15-38.0	980619	03:33	03:53	ORI	0.69	Surf.				2.0	1957
	142-44.4	142-44.2											
42	16-33.0	16-33.1	980619	23:59	01:34	IKMT	0.5	Step	571	0-203	1.0-0.5	2.0	39327
	143-08.3	143-12.0											
42	16-33.0	16-33.1	980620	00:01	00:21	ORI	0.69	Surf.				2.0	2302
	143-08.4	143-09.2											
43	16-30.5	16-28.5	980620	02:02	03:10	IKMT	0.5	Step	516	0-207	1.0-0.5	2.0	26264
	143-12.1	143-12.9											

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
43	16-30.5	16-29.8	980620	02:04	02:24	ORI	0.69	Surf.				2.0	2442
	143-12.2	143-12.4											
44	16-26.8	16-26.8	980620	03:45	04:58	IKMT	0.5	Step	613	0-210	1.0-0.5	2.0	33649
	143-09.6	143-07.4											
44	16-26.8	16-26.8	980620	03:46	04:06	ORI	0.69	Surf.				2.0	2259
	143-09.5	143-08.9											
45	16-29.3	16-30.8	980620	05:37	06:47	IKMT	0.5	Step	585	0-217	1.0-0.5	2.0	30676
	143-06.0	143-04.8											
45	16-29.3	16-29.8	980620	05:38	05:58	ORI	0.69	Surf.				2.0	2122
	143-06.1	143-05.7											
46	16-29.3	16-29.3	980621	00:00	01:01	IKMT	0.5	Step	485	0-177	1.0-0.5	2.0	26430
	143-09.6	143-07.6											
46	16-29.3	16-29.3	980621	00:04	00:24	ORI	0.69	Surf.				2.0	2192
	143-09.4	143-08.8											
47	16-29.3	16-31.4	980621	01:22	02:24	IKMT	0.5	Step	555	0-168	1.0-0.5	2.0	28949
	143-08.3	143-07.6											
47	16-29.3	16-30.1	980621	01:24	01:44	ORI	0.69	Surf.				2.0	2042
	143-08.3	143-08.0											
48	16-30.7	16-30.5	980621	02:47	03:49	IKMT	0.5	Step	452	0-175	1.0-0.5	2.0	25185

Time is indicated in SMT

KH98-2 Net Record

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m^3)
	143-08.4	143-10.9											
48	16-30.7	16-30.6	980621	02:48	03:08	ORI	0.69	Surf.				2.0	2323
	143-08.5	143-09.3											
49	16-30.6	16-28.2	980621	04:16	05:19	IKMT	0.5	Step	580	0-174	1.0-0.5	2.0	30715
	143-09.9	143-09.6											
49	16-30.6	16-29.8	980621	04:17	04:37	ORI	0.69	Surf.				2.0	2487
	143-09.9	143-09.8											
50	16-30.7	16-30.7	980622	00:00	01:36	IKMT	0.5	Obl.	887	0-302	0.7-0.2	2.0	43654
	143-07.5	143-11.2											
50	16-30.7	16-30.7	980622	00:04	00:34	ORI	0.69	Surf.				2.0	3483
	143-07.7	143-08.8											
51	16-31.2	16-28.3	980622	02:07	03:39	IKMT	0.5	Obl.	868	0-359	0.8-0.2	2.0	36690
	143-10.0	143-09.9											
51	16-31.2	16-30.3	980622	02:09	02:39	ORI	0.69	Surf.				2.0	3490
	143-10.0	143-09.9											
52	16-29.2	16-29.0	980622	04:03	05:28	IKMT	0.5	Obl.	761	0-307	0.9-0.2	2.0	34602
	143-10.6	143-08.3											
52	16-29.2	16-29.2	980622	04:04	04:34	ORI	0.69	Surf.				2.0	3366
	143-10.5	143-09.7											

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
53	15-38.8	15-38.7	980622	21:29	22:28	IKMT	0.5	Obl.	701	0-258	1.0-0.3	2.0	26212
	142-44.6	142-46.4											
53	15-38.8	15-38.7	980622	21:31	21:51	ORI	0.69	Surf.				2.0	2406
	142-44.7	142-45.3											
54	15-38.8	15-36.6	980622	22:39	23:42	IKMT	0.5	Obl.	735	0-252	0.7-0.3	2.0	28354
	142-46.7	142-46.5											
54	15-38.8	15-38.0	980622	22:41	23:01	ORI	0.69	Surf.				2.0	2626
	142-46.6	142-46.6											
55	15-36.6	15-36.9	980622	23:56	01:17	IKMT	0.5	Obl.	741	0-255	0.7-0.2	2.0	34795
	142-46.7	142-43.2											
55	15-36.6	15-36.8	980623	00:16	00:46	ORI	0.69	Surf.				2.0	3002
	142-45.7	142-44.5											
56	15-36.5	15-38.9	980623	01:42	02:46	IKMT	0.5	Obl.	735	0-253	0.6-0.3	2.0	28880
	142-44.4	142-44.0											
56	15-37.2	15-37.9	980623	02:00	02:20	ORI	0.69	Surf.				2.0	1910
	142-44.4	142-44.2											
57	16-28.0	16-29.4	980623	22:52	00:30	IKMT	0.5	Obl.	1205	0-507	0.7-0.3	2.0	38762
	143-10.6	143-08.2											
57	16-28.3	16-28.7	980623	23:11	23:41	ORI	0.69	Surf.				2.0	2966

Time is indicated in SMT

KH98-2 Net Record

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m³)
	143-10.1	143-09.3											
58	16-30.1	16-33.0	980624	00:49	02:49	IKMT	0.5	Obl.	1565	0-510	0.8-0.3	2.0	57742
	143-07.6	143-11.6											
58	16-30.1	16-31.1	980624	00:50	01:30	ORI	0.69	Surf.				2.0	3949
	143-07.6	143-09.0											
59	15-37.6	15-39.7	980624	21:44	23:28	IKMT	0.5	Obl.	1269	0-664	0.7-0.5	2.0	42390
	142-43.8	142-46.0											
59	15-38.2	15-39.1	980624	20:15	20:55	ORI	0.69	Surf.				2.0	4518
	142-44.5	142-45.3											
60	15-38.9	15-34.8	980624	23:47	01:41	IKMT	0.5	Obl.	1392	0-505	0.7-0.5	2.0	54908
	142-47.0	142-46.7											
60	15-38.0	15-36.5	980625	00:14	00:54	ORI	0.69	Surf.				2.0	5359
	142-46.8	142-46.8											
61	15-35.9	15-37.4	980625	02:04	03:26	IKMT	0.5	Obl.	1293	0-451	0.8-0.5	2.0	37462
	142-46.7	142-43.4											
61	15-36.4	15-37.1	980625	02:29	03:09	ORI	0.69	Surf.				2.0	4184
	142-45.6	142-44.0											
62	16-29.3	16-30.9	980625	11:59	13:15	IKMT	0.5	Obl.	555	0-298	0.5-0.2	2.0	-
	143-10.1	143-10.4											

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m³)
62	16-29.4	16-30.1	980625	12:01	12:41	ORI	0.69	Surf.				2.0	3697
	143-10.1	143-10.2											
63	16-30.9	16-30.5	980625	13:29	14:52	IKMT	0.5	Obl.	952	0-304	0.4-0.5	2.0	38299
	143-10.0	143-07.2											
63	16-30.9	16-30.7	980625	13:31	14:11	ORI	0.69	Surf.				2.0	4478
	143-09.9	143-08.7											
64	16-31.1	16-28.6	980625	16:03	17:14	IKMT	0.5	Obl.	789	0-301	0.7-0.5	2.0	30407
	143-08.0	143-07.6											
64	16-30.8	16-30.1	980625	16:13	16:33	ORI	0.69	Surf.				2.0	2231
	143-07.8	143-07.7											
65	16-28.9	16-28.7	980625	17:39	18:54	IKMT	0.5	Obl.	843	0-299	0.8-0.5	2.0	36701
	143-08.0	143-10.8											
65	16-28.9	16-28.9	980625	17:50	18:10	ORI	0.69	Surf.				2.0	2256
	143-08.4	143-09.1											
66	16-29.9	16-32.4	980625	23:07	00:45	IKMT	0.5	Step	861	0-311	0.7-0.5	2.0	31631
	143-10.5	143-11.8											
66	16-29.5	16-30.2	980625	23:25	23:45	ORI	0.69	Surf.				2.0	2181
	143-10.8	143-11.0											
67	16-31.4	16-31.4	980626	01:16	02:33	IKMT	0.5	Step	678	0-314	0.6-0.5	2.0	25091

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
	143-10.0	143-08.3											
67	16-31.4	16-31.4	980626	01:30	01:50	ORI	0.69	Surf.				2.0	2203
	143-09.7	143-09.3											
68	16-30.9	16-28.7	980626	02:53	04:01	IKMT	0.5	Obl.	861	0-304	0.4-0.5	2.0	20772
	143-07.5	43-07.32											
68	16-30.4	16-29.7	980626	03:10	03:30	ORI	0.69	Surf.				2.0	2212
	143-07.4	143-07.4											
69	15-38.5	15-35.0	980627	00:04	01:38	IKMT	0.5	Obl.	1044	0-301	0.7-0.5	2.0	31952
	142-44.8	142-43.1											
69	15-37.8	15-36.7	980627	00:25	00:55	ORI	0.69	Surf.				2.0	3451
	142-44.4	142-43.9											
70	15-36.4	15-36.1	980627	02:10	03:17	IKMT	0.5	Obl.	795	0-310	0.6-0.3	2.0	21787
	142-44.7	142-46.2											
70	15-36.3	15-36.1	980627	02:30	03:00	ORI	0.69	Surf.				2.0	3435
	142-45.2	142-45.8											
71	15-38.4	15-38.7	980627	03:50	05:02	IKMT	0.5	Obl.	747	0-319	0.6-0.2	2.0	26657
	142-44.7	142-46.2											
71	15-38.6	15-38.7	980627	04:10	04:40	ORI	0.69	Surf.				2.0	3424
	142-45.2	142-45.7											

Time is indicated in SMT

KH98-2 Net Record

St.	Location Net in	Location Net out	Date	Time Net in	Time Net out	Net Type	Mesh size (mm)	Towing Method	Wire out (m)	Sampl. layer (m)	Reel. speed (m/s)	Ship speed (kt)	Filt. volume (m^3)
72	16-28.8 143-10.0	16-30.9 143-10.3	980627	13:03	14:16	IKMT	0.5	Obl.	704	0-312	0.5-0.2	2.0	20108
72	16-29.5 143-10.1	16-30.3 143-10.2	980627	13:25	13:55	ORI	0.69	Surf.				2.0	2884
73	16-30.9 143-10.0	16-30.7 143-07.4	980627	14:29	15:58	IKMT	0.5	Obl.	894	0-313	0.7-0.2	2.0	38536
73	16-30.9 143-09.4	16-30.8 143-08.6	980627	14:50	15:20	ORI	0.69	Surf.				2.0	3376
74	16-30.9 143-07.9	16-30.6 143-10.7	980627	20:19	21:22	IKMT	0.5	Obl.	848	*0-300	0.8-0.3	2.0	14279
74	16-30.9 143-08.2	16-30.8 143-09.1	980627	20:30	20:50	ORI	0.69	Surf.				2.0	2364
75	16-30.8 143-10.0	16-28.1 143-10.3	980627	21:43	22:52	IKMT	0.5	Obl.	905	*0-299	0.9-0.3	2.0	32228
75	16-30.5 143-10.0	16-29.6 143-10.2	980627	21:50	22:10	ORI	0.69	Surf.				2.0	2589
76	16-28.0 143-10.2	16-28.4 143-08.9	980627	23:00	23:58	IKMT	0.5	Obl.	749	*0-304	0.7-0.3	2.0	37178
76	16-28.1	16-28.3	980627	23:10	23:30	ORI	0.69	Surf.				2.0	1963

Time is indicated in SMT

KH98-2 Net Record

St.	Location		Date	Time		Net	Mesh	Towing	Wire	Sampl.	Reel.	Ship	Filt.
	Net in	Net out		Net in	Net out	Type	size (mm)	Method	out (m)	layer (m)	speed (m/s)	speed (kt)	volume (m^3)
	143-10.0	143-09.5											
77	23-52.3	23-57.2	980629	13:06	15:03	ORI	0.33	Obl.	2000	–	0.8-0.3	2.0	7805
	142-00.9	142-00.2											

Time is indicated in SMT

Ⅶ. CTDO data

CTD data

St.01 23 May 10:41-11:58				
32-01.03N 142-49.29E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	23.20	34.73	4.42	23.67
10	23.19	34.73	4.41	23.67
20	23.16	34.73	4.41	23.68
30	22.68	34.75	4.45	23.83
40	21.85	34.76	4.46	24.08
50	21.54	34.76	4.46	24.17
75	20.82	34.81	4.36	24.40
100	20.13	34.83	4.40	24.60
125	19.61	34.82	4.40	24.73
150	19.16	34.82	4.51	24.84
175	18.93	34.82	4.53	24.90
200	18.67	34.80	4.53	24.95
250	18.29	34.80	4.46	25.04
300	18.06	34.82	4.35	25.12
400	16.75	34.77	4.16	25.39
500	14.20	34.58	3.95	25.82
600	11.70	34.42	3.66	26.19
700	9.09	34.27	3.31	26.53
800	6.47	34.11	2.99	26.79
900	5.37	34.17	2.17	26.98
1000	4.64	34.25	1.72	27.12
1012	4.78	34.29	1.72	27.14

St.02 23 May 20:46-02:34				
30-01.44N 142-51.93E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	24.54	34.95	4.28	23.44
10	24.54	34.94	4.26	23.44
20	24.52	34.94	4.25	23.44
30	22.93	34.79	4.42	23.80
40	21.41	34.73	4.68	24.17
50	20.27	34.75	4.78	24.50
75	19.45	34.81	4.69	24.76
100	19.02	34.81	4.60	24.87
125	18.80	34.81	4.60	24.93
150	18.56	34.80	4.62	24.98
175	18.31	34.81	4.55	25.05
200	18.09	34.79	4.65	25.09
250	17.58	34.82	4.21	25.24
300	16.84	34.78	4.17	25.38
400	14.98	34.64	4.05	25.70
500	12.57	34.47	3.84	26.06
600	9.44	34.24	3.69	26.45
700	6.82	34.10	3.29	26.73
800	5.44	34.10	2.53	26.91
900	4.57	34.18	1.72	27.07
1000	4.17	34.27	1.39	27.19
1500	2.58	34.50	1.20	27.52
2000	1.98	34.60	1.70	27.65
2500	1.69	34.64	2.35	27.71
3000	1.56	34.66	2.74	27.74
3500	1.49	34.68	2.96	27.75
4000	1.47	34.68	3.14	27.76
4500	1.47	34.69	3.27	27.76
5000	1.50	34.69	3.37	27.76
5500	1.56	34.69	3.39	27.76
6000	1.62	34.69	3.48	27.75
6407	1.68	34.69	3.42	27.75

St.03 24 May 23:20-04:40				
27-29.44N 143-48.83E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	25.93	35.01	4.15	23.06
10	25.93	35.02	4.14	23.07
20	25.43	35.04	4.23	23.24
30	22.94	34.97	4.56	23.93
50	21.51	34.96	4.64	24.33
75	20.88	34.95	4.65	24.49
100	20.06	34.88	4.62	24.66
125	19.37	34.83	4.63	24.80
150	19.03	34.81	4.64	24.87
175	18.68	34.79	4.64	24.95
200	18.56	34.78	4.67	24.97
250	18.27	34.82	4.47	25.06
300	17.50	34.83	4.26	25.26
400	15.92	34.71	4.21	25.55
500	13.95	34.56	4.10	25.86
600	10.91	34.32	4.01	26.26
700	8.14	34.15	3.57	26.59
800	5.89	34.09	2.71	26.85
900	4.93	34.15	1.92	27.01
1000	4.22	34.25	1.33	27.16
1500	2.54	34.50	1.14	27.53
2000	1.95	34.60	1.81	27.66
2500	1.66	34.65	2.43	27.71
3000	1.55	34.66	2.75	27.74
3500	1.49	34.68	2.96	27.75
4000	1.47	34.68	3.11	27.76
4500	1.48	34.69	3.25	27.76
5000	1.51	34.69	3.27	27.76
5500	1.56	34.69	3.37	27.76
6000	1.62	34.69	3.36	27.75
6205	1.65	34.69	3.38	27.75

St.04 25 May 20:17-00:12				
24-59.94N 143-30.90E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	26.67	35.02	4.06	22.84
10	26.67	35.02	4.05	22.84
20	26.67	35.02	4.04	22.84
30	25.37	35.01	4.28	23.23
40	24.16	35.01	4.41	23.60
50	22.66	34.99	4.58	24.03
75	21.31	34.93	4.69	24.35
100	20.12	34.88	4.76	24.64
125	19.16	34.82	4.73	24.85
150	18.81	34.81	4.65	24.92
175	18.70	34.80	4.67	24.94
200	18.55	34.82	4.54	24.99
250	17.54	34.83	4.28	25.26
300	16.43	34.76	4.26	25.46
400	14.00	34.56	4.19	25.85
500	11.09	34.32	4.11	26.23
600	8.21	34.16	3.52	26.58
700	5.95	34.11	2.50	26.86
800	5.01	34.20	1.69	27.04
900	4.30	34.29	1.31	27.19
1000	3.84	34.35	1.18	27.29
1500	2.52	34.53	1.52	27.55
2000	1.98	34.61	2.11	27.66
2500	1.72	34.64	2.54	27.71
3000	1.59	34.66	2.81	27.73
3500	1.50	34.68	3.05	27.75
4000	1.48	34.68	3.20	27.76
4015	1.48	34.68	3.21	27.76

CTD data

St.05 26 May 15:53-18:13				
22-00.08N 142-00.64E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.22	34.67	3.99	22.08
10	28.21	34.68	4.00	22.08
20	28.07	34.75	4.01	22.18
30	27.91	34.96	4.03	22.39
40	27.00	34.92	4.18	22.66
50	26.33	34.93	4.27	22.88
75	25.42	34.92	4.24	23.15
100	24.55	34.96	4.22	23.45
125	23.66	35.00	4.22	23.74
150	22.79	35.01	4.15	24.00
175	21.70	34.98	4.14	24.29
200	20.52	34.99	4.06	24.62
250	17.98	34.87	4.19	25.18
300	16.85	34.80	4.39	25.40
400	14.60	34.59	4.39	25.74
500	10.78	34.30	3.98	26.27
600	8.23	34.20	2.90	26.61
700	6.59	34.20	2.16	26.85
800	5.51	34.24	1.76	27.01
900	4.43	34.32	1.52	27.20
1000	4.01	34.36	1.46	27.28
1024	3.77	34.39	1.46	27.32

St.07 27 May 05:54-06:44				
20-00.12N 141-59.30E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.25	34.91	3.97	22.24
10	28.25	34.91	3.96	22.24
20	28.25	34.91	3.97	22.24
30	28.26	34.91	3.96	22.24
40	27.50	34.87	4.10	22.46
50	26.89	34.89	4.22	22.67
75	25.24	34.95	4.24	23.23
100	24.19	34.98	4.20	23.57
125	22.59	35.00	4.15	24.05
150	21.10	34.97	4.08	24.45
175	19.85	34.96	4.07	24.77
200	19.03	34.93	4.10	24.96
250	17.96	34.87	4.16	25.18
300	16.38	34.75	4.31	25.47
400	12.11	34.38	4.07	26.08
500	9.06	34.23	3.18	26.51
600	7.43	34.26	2.16	26.78
700	5.96	34.26	1.75	26.97
800	5.08	34.33	1.48	27.14
900	4.53	34.40	1.52	27.26
1000	4.01	34.45	1.51	27.35

St.08 27 May 12:44-13:31				
19-00.11N 142-00.30E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.43	34.83	3.94	22.12
10	28.29	34.84	3.94	22.18
20	28.25	34.91	3.94	22.24
30	28.11	34.96	3.96	22.33
40	27.10	34.94	4.13	22.64
50	26.18	34.93	4.22	22.92
75	24.62	34.94	4.21	23.41
100	23.20	35.00	4.23	23.88
125	21.65	34.98	4.25	24.30
150	20.49	34.98	4.03	24.62
175	19.51	34.93	4.11	24.83
200	18.78	34.90	4.16	25.00
250	17.40	34.83	4.27	25.29
300	16.25	34.75	4.37	25.49
400	12.82	34.45	4.19	26.00
500	9.19	34.24	3.12	26.49
600	6.81	34.18	2.35	26.80
700	5.54	34.25	1.62	27.02
800	4.85	34.32	1.41	27.16
900	4.23	34.42	1.43	27.30
1000	3.83	34.47	1.54	27.38
1026	3.72	34.48	1.56	27.40

St.09 27 May 19:30-20-14				
17-59.17N 141-59-70E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.52	34.66	3.92	21.97
10	28.52	34.66	3.92	21.97
20	28.53	34.66	3.91	21.96
30	28.52	34.66	3.93	21.97
40	28.42	34.66	3.92	22.00
50	28.17	34.95	3.98	22.30
75	26.04	34.92	4.24	22.96
100	25.09	34.98	4.27	23.30
125	24.18	35.01	4.06	23.59
150	22.53	35.01	4.11	24.08
175	20.89	35.00	4.06	24.53
200	19.28	34.96	4.11	24.92
250	17.81	34.87	4.32	25.22
300	15.80	34.70	4.24	25.56
400	12.01	34.38	3.89	26.10
500	8.54	34.20	3.00	26.57
600	6.47	34.20	2.11	26.86
700	5.51	34.28	1.56	27.05
800	4.82	34.40	1.59	27.22
900	4.36	34.45	1.70	27.31
1000	3.90	34.49	1.77	27.39
1011	3.86	34.49	1.76	27.40

CTD data

St.10 28 May 06:39-07:25				
16-59.98N 141-59.70E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.50	34.82	3.91	22.09
10	28.50	34.82	3.93	22.09
20	28.51	34.82	3.93	22.09
30	28.31	34.79	3.95	22.14
40	28.14	34.78	3.95	22.19
50	27.70	34.82	4.04	22.36
75	25.30	34.98	4.17	23.23
100	23.96	35.02	4.13	23.67
125	22.34	35.00	3.92	24.13
150	20.48	34.94	3.71	24.59
175	18.80	34.89	3.69	24.99
200	17.95	34.87	4.07	25.18
250	15.31	34.64	3.93	25.62
300	13.25	34.47	4.09	25.93
400	9.58	34.23	3.55	26.42
500	7.18	34.20	2.38	26.76
600	6.01	34.31	1.69	27.01
700	5.15	34.38	1.65	27.17
800	4.68	34.45	1.80	27.28
900	4.25	34.50	1.89	27.36
1000	3.87	34.52	1.94	27.41
1002	3.86	34.52	1.95	27.42

St.11 28 May 16:56-17:40				
16-00.37N 141-57.74E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.73	34.76	3.89	21.98
10	28.73	34.76	3.89	21.97
20	28.72	34.76	3.89	21.98
30	28.64	34.76	3.90	22.00
40	28.28	34.77	3.98	22.13
50	27.98	34.76	4.00	22.22
75	26.27	34.89	4.17	22.86
100	25.46	34.95	4.15	23.16
125	24.11	35.01	4.08	23.61
150	22.25	35.02	3.86	24.16
175	20.55	34.96	3.81	24.59
200	19.08	34.89	3.73	24.92
250	16.47	34.77	4.23	25.46
300	13.88	34.53	4.16	25.85
400	9.54	34.23	3.57	26.43
500	7.43	34.25	2.25	26.77
600	6.10	34.34	1.67	27.02
700	5.41	34.42	1.65	27.17
800	4.85	34.47	1.73	27.28
900	4.45	34.51	1.82	27.35
1000	4.07	34.53	1.91	27.40
1014	4.02	34.53	1.90	27.41

St.12 29 May 01:33-05:46				
15-04.56N 142-03.64E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.59	34.66	3.91	21.95
10	28.61	34.66	3.91	21.94
20	28.59	34.66	3.89	21.95
30	28.58	34.66	3.90	21.95
40	28.27	34.66	3.98	22.05
50	28.20	34.76	3.97	22.15
75	27.24	34.74	4.01	22.44
100	25.97	34.87	4.03	22.94
125	24.66	34.92	3.96	23.38
150	23.56	34.97	3.94	23.75
175	21.85	35.00	3.83	24.26
200	19.80	34.96	3.95	24.78
250	16.66	34.77	4.11	25.42
300	13.75	34.52	3.88	25.87
400	9.37	34.29	2.84	26.50
500	7.52	34.37	1.59	26.85
600	6.58	34.41	1.49	27.01
700	5.86	34.46	1.69	27.14
800	5.31	34.48	1.80	27.22
900	4.83	34.50	1.85	27.30
1000	4.32	34.52	1.92	27.37
1500	2.85	34.59	2.08	27.57
2000	2.04	34.63	2.47	27.67
2500	1.70	34.66	2.79	27.72
3000	1.66	34.66	2.90	27.73
3500	1.53	34.68	3.17	27.75
4000	1.49	34.69	3.34	27.76

St.13 29 May 09:48-10:36				
14-00.15N 142-00.04E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.47	34.63	3.94	21.96
10	28.45	34.63	3.92	21.97
20	28.45	34.63	3.93	21.97
30	28.46	34.64	3.93	21.98
40	28.16	34.61	3.96	22.05
50	28.10	34.61	3.95	22.07
75	28.04	34.61	3.96	22.09
100	27.59	34.56	4.00	22.20
125	26.18	34.75	3.99	22.79
150	23.03	34.91	3.91	23.86
175	20.44	34.86	3.70	24.54
200	19.43	34.79	3.55	24.75
250	14.47	34.57	3.62	25.75
300	12.18	34.43	3.31	26.11
400	9.09	34.28	2.95	26.54
500	7.15	34.36	1.72	26.89
600	6.24	34.45	1.52	27.09
700	5.73	34.48	1.54	27.18
800	5.15	34.50	1.64	27.26
900	4.62	34.52	1.76	27.34
1000	4.24	34.53	1.89	27.39
1010	4.18	34.53	1.91	27.39

CTD data

St.A5 29 May 15:20-16:08					St.14 30 May 01:36-07:14					St.15 31 May 21:36-05:14				
13-30.08N 142-00.00					11-22.16N 142-35.00E					14-00.03N 146-59.30E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)	P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)	P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	28.59	34.64	3.97	21.93	5	28.86	34.77	3.91	21.94	5	28.38	34.72	3.94	22.06
10	28.61	34.64	3.95	21.93	10	28.86	34.77	3.91	21.94	10	28.37	34.72	3.95	22.06
20	28.45	34.64	3.96	21.98	20	28.87	34.78	3.89	21.94	20	28.35	34.71	3.93	22.06
30	28.43	34.64	3.95	21.99	30	28.87	34.78	3.89	21.94	30	28.31	34.71	3.95	22.07
40	28.42	34.65	3.95	21.99	40	28.79	34.79	3.91	21.98	40	28.29	34.70	3.94	22.07
50	28.42	34.65	3.95	21.99	50	28.65	34.77	3.92	22.01	50	28.24	34.69	3.94	22.08
75	28.17	34.62	3.97	22.06	60	28.40	34.72	3.94	22.06	75	27.93	34.62	3.96	22.13
100	27.61	34.54	4.02	22.18	75	28.39	34.74	3.94	22.07	100	27.82	34.61	3.98	22.16
125	27.36	34.57	4.03	22.28	100	27.60	34.61	4.01	22.23	125	27.14	34.58	4.05	22.36
150	26.13	34.76	4.05	22.81	125	24.85	34.70	3.91	23.16	150	24.97	34.72	4.03	23.14
175	20.11	34.86	3.72	24.63	150	20.09	34.71	3.44	24.52	175	20.31	34.77	3.59	24.50
200	18.32	34.76	3.48	25.01	175	15.83	34.65	3.23	25.51	200	17.67	34.73	3.43	25.15
250	13.32	34.50	3.61	25.94	200	14.01	34.55	3.14	25.84	250	14.05	34.53	3.73	25.81
300	11.35	34.35	3.55	26.20	250	11.01	34.43	2.72	26.33	300	11.88	34.37	3.88	26.12
400	8.20	34.30	2.25	26.69	300	9.61	34.46	2.11	26.60	400	8.78	34.33	2.15	26.63
500	6.99	34.41	1.52	26.96	400	8.10	34.45	1.89	26.83	500	7.59	34.42	1.88	26.88
600	6.28	34.45	1.60	27.09	500	7.06	34.47	1.96	26.99	600	6.60	34.45	1.63	27.04
700	5.63	34.48	1.81	27.19	600	6.71	34.51	1.90	27.07	700	5.78	34.50	1.89	27.18
800	5.15	34.50	1.89	27.26	700	6.15	34.51	1.89	27.15	800	5.20	34.51	1.96	27.27
900	4.62	34.52	1.85	27.34	800	5.68	34.52	1.92	27.22	900	4.59	34.53	1.86	27.35
1000	4.20	34.54	1.75	27.40	900	5.21	34.53	1.90	27.28	1000	4.21	34.54	1.82	27.40
1011	4.15	34.54	1.80	27.40	1000	4.83	34.54	1.87	27.33	1500	2.86	34.59	2.04	27.57
					1500	3.22	34.58	2.03	27.53	2000	2.16	34.63	2.41	27.66
					2000	2.32	34.62	2.38	27.64	2500	1.81	34.65	2.70	27.71
					2500	1.86	34.65	2.64	27.70	3000	1.64	34.67	2.91	27.73
					3000	1.68	34.66	2.86	27.73	3500	1.56	34.68	3.11	27.75
					3500	1.53	34.68	3.15	27.75	4000	1.49	34.68	3.34	27.76
					4005	1.44	34.69	3.46	27.79	4500	1.47	34.69	3.53	27.76
					4500	1.43	34.69	3.61	27.77	5000	1.48	34.69	3.67	27.77
					5000	1.47	34.69	3.74	27.77	5500	1.52	34.69	3.78	27.76
					5500	1.52	34.70	3.73	27.76	6000	1.58	34.69	3.78	27.76
					6000	1.58	34.70	3.83	27.76	6500	1.65	34.69	3.80	27.75

CTD data

St.CTD1 16 June 23:42-00:40 16-31.36N 143-08.04E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	29.17	34.73	3.87	21.81
10	29.16	34.73	3.87	21.81
20	29.17	34.73	3.89	21.81
30	29.17	34.73	3.88	21.81
40	29.13	34.73	3.89	21.82
50	28.7	34.69	3.98	21.93
75	28.4	34.73	4.02	22.06
100	27.55	34.77	4.04	22.37
125	26.86	34.8	4.13	22.61
150	25.51	34.92	4.13	23.12
175	22.78	35.01	3.97	24
200	20.84	35	3.92	24.54
250	17.93	34.85	4.07	25.18
300	15.44	34.65	4.13	25.61
400	10.98	34.33	3.64	26.26
500	8.2	34.35	2.08	26.74
600	6.72	34.38	1.83	26.97
700	5.74	34.4	1.81	27.11
800	5.17	34.46	1.82	27.22
900	4.71	34.49	1.87	27.3
1000	4.33	34.51	1.96	27.36
1016	4.26	34.52	1.97	27.37

St.CTD2 23 June 12:19-12:54 16-29.98N 143-11.02E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	29.39	34.68	3.88	21.69
10	29.39	34.68	3.87	21.69
20	29.27	34.67	3.88	21.73
30	29.21	34.68	3.88	21.76
40	29.18	34.71	3.87	21.79
50	29.08	34.74	3.88	21.84
75	28.49	34.79	3.95	22.08
100	28.02	34.77	4	22.21
125	26.85	34.79	4.1	22.61
150	25.69	34.81	3.98	22.98
175	23.41	34.97	3.94	23.8
200	21.21	34.97	3.86	24.41
250	18.36	34.88	4.03	25.09
300	16.4	34.75	4.25	25.46
400	11.93	34.41	3.63	26.15
500	8.85	34.32	2.34	26.61
600	7.34	34.37	1.75	26.87
700	6.19	34.38	1.75	27.04
800	5.54	34.42	1.72	27.15
823	5.37	34.43	1.73	27.18

St.CTD3 23 June 13:35-14:19 16-28.49N 143-08.92E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	29.36	34.67	3.9	21.7
10	29.28	34.67	3.91	21.72
20	29.22	34.67	3.93	21.74
30	29.2	34.68	3.93	21.75
40	29.18	34.69	3.92	21.77
50	29.13	34.71	3.92	21.8
75	28.93	34.77	3.93	21.91
100	28.27	34.76	3.98	22.13
125	26.88	34.77	4	22.58
150	25.43	34.77	3.94	23.04
175	23.4	34.98	3.91	23.8
200	20.27	34.97	3.88	24.66
250	17.67	34.86	4.14	25.24
300	16.15	34.73	4.3	25.5
400	10.71	34.34	3.59	26.32
500	8.98	34.32	2.38	26.59
600	7.01	34.36	1.79	26.92
700	5.99	34.38	1.72	27.07
800	5.4	34.43	1.72	27.18
816	5.34	34.43	1.72	27.19

St.CDT4 26 June 10:28-11:11 15-04.56N 142-03.64E				
P (db)	Temp. (℃)	Sal. (psu)	Ox (ml/l)	Sig-t (kg/m3)
5	29.16	34.67	3.97	21.76
10	29.12	34.67	3.95	21.78
20	29.1	34.67	3.97	21.78
30	29.08	34.67	3.97	21.79
40	29.02	34.68	3.97	21.82
50	28.8	34.71	3.99	21.91
75	27.41	34.66	4.14	22.33
100	26.79	34.76	4.16	22.61
125	25.51	34.87	4.11	23.09
150	24.44	34.94	4.09	23.46
175	21.71	35.02	3.97	24.32
200	19.77	34.96	4.12	24.8
250	17.86	34.87	4.36	25.2
300	14.74	34.6	4.22	25.72
400	9.38	34.28	3.14	26.5
500	7.63	34.34	2.01	26.81
600	6.74	34.41	1.62	26.99
700	6.1	34.45	1.61	27.11
800	5.55	34.47	1.72	27.19
900	5.01	34.5	1.78	27.28
1000	4.54	34.51	1.89	27.34
1014	4.48	34.52	1.9	27.35

Ⅷ. Station and working log of KH-98-2

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-1	5 23	1 39 +09S	32 ° 1.68 N	142 ° 49.40 E	6069	CTD START
ST-1	5 23	2 6 +09S	32 ° 2.02 N	142 ° 49.30 E	6065	CTD DEEPEST
ST-1	5 23	2 59 +09S	32 ° 2.57 N	142 ° 49.30 E	6059	CTD FINISHED
ST-2	5 23	11 46 +09S	30 ° 0.43 N	142 ° 51.90 E	7317	CTD-CMS START
ST-2	5 23	13 45 +09S	30 ° 1.30 N	142 ° 51.90 E	7211	CTD-CMS DEEPEST
ST-2	5 23	14 8 +09S	30 ° 1.44 N	142 ° 51.90 E	7171	CTD-CMS DEEPEST
ST-2	5 23	17 34 +09S	30 ° 2.04 N	142 ° 51.20 E	7238	CTD-CMS FINISH
ST-2	5 23	18 6 +09S	30 ° 2.27 N	142 ° 51.20 E	7242	MULTI STARTED
ST-2	5 23	20 53 +09S	30 ° 1.89 N	142 ° 51.70 E	7190	MULTI HIT BOTTOM
ST-2	5 23	22 51 +09S	30 ° 1.80 N	142 ° 52.00 E	7170	MULTI ON DECK
ST-2	5 23	23 12 +09S	30 ° 1.80 N	142 ° 52.00 E	7164	ORI NET START
ST-2	5 23	23 38 +09S	30 ° 1.93 N	142 ° 52.20 E	7140	ORI NET DEEPEST
ST-2	5 23	23 44 +09S	30 ° 1.96 N	142 ° 52.30 E	7132	ORI SIDE NET START
ST-2	5 24	0 14 +09S	30 ° 2.17 N	142 ° 52.70 E	7097	ORI SIDE NET FINISH
ST-2	5 24	0 41 +09S	30 ° 2.38 N	142 ° 53.00 E	7074	ORI NET FINISH
ST-3	5 24	12 10 +09S	27 ° 30.06 N	143 ° 50.00 E	6512	ORI NET START
ST-3	5 24	12 26 +09S	27 ° 29.77 N	143 ° 49.90 E	6514	ORI SIDE NET START
ST-3	5 24	12 39 +09S	27 ° 29.69 N	143 ° 49.90 E	6513	ORI SIDE NET FINISH
ST-3	5 24	12 43 +09S	27 ° 29.69 N	143 ° 49.90 E	6513	ORI NET DEEPEST
ST-3	5 24	12 55 +09S	27 ° 29.48 N	143 ° 50.00 E	6510	ORI SIDE NET START
ST-3	5 24	13 10 +09S	27 ° 29.24 N	143 ° 50.10 E	6511	ORI SIDE NET FINISH
ST-3	5 24	13 16 +09S	27 ° 29.16 N	143 ° 50.10 E	6511	ORI SIDE NET FINISH
ST-3	5 24	14 3 +09S	27 ° 28.77 N	143 ° 49.90 E	6523	ORI NET FINISH
ST-3	5 24	14 21 +09S	27 ° 28.67 N	143 ° 49.70 E	6532	DTD-CMS START
ST-3	5 24	16 14 +09S	27 ° 29.24 N	143 ° 48.80 E	6601	CTD-CMS DEEPEST
ST-3	5 24	19 41 +09S	27 ° 31.35 N	143 ° 48.30 E	6607	CTD-CMS FINISH
ST-3	5 24	20 3 +09S	27 ° 31.52 N	143 ° 48.10 E	6634	MULTI STARTED
ST-3	5 24	22 17 +09S	27 ° 31.38 N	143 ° 48.20 E	6612	MULTI HIT BOTTOM
ST-3	5 25	0 9 +09S	27 ° 31.11 N	143 ° 48.90 E	6637	MULTI ON DECK
	5 25	11 6 +09S	24 ° 59.96 N	143 ° 30.30 E	5383	CTD-CMS START
ST-4	5 25	12 38 +09S	24 ° 59.94 N	143 ° 30.90 E	5934	CTD-CMS DEEPEST
ST-4	5 25	15 13 +09S	25 ° 0.62 N	143 ° 32.20 E	9718	CTD-CMS FINISH
ST-4	5 25	15 25 +09S	25 ° 0.54 N	143 ° 32.20 E	9795	IKMT NET START
ST-4	5 25	15 36 +09S	25 ° 0.20 N	143 ° 32.30 E	9790	ORI SIDE NET START
ST-4	5 25	15 58 +09S	24 ° 59.41 N	143 ° 32.00 E	9799	ORI SIDE NET FINISH
ST-4	5 25	16 36 +09S	24 ° 57.99 N	143 ° 31.30 E	4928	IKMT NET DEEPEST
ST-4	5 25	17 37 +09S	24 ° 56.64 N	143 ° 30.70 E	5112	IKMT NET FINISH
ST-5	5 26	6 55 +09S	22 ° 0.02 N	142 ° 0.16 E	1909	DTD-CMS START
ST-5	5 26	7 44 +09S	22 ° 0.01 N	142 ° 0.91 E	2133	CTD-CMS DEEPEST
ST-5	5 26	9 14 +09S	22 ° 0.30 N	142 ° 2.99 E	2341	CTD-CMS FINISH
ST-5	5 26	9 23 +09S	22 ° 0.13 N	142 ° 3.19 E	2408	ORI NET START
ST-5	5 26	9 37 +09S	21 ° 59.53 N	142 ° 3.47 E	2429	ORI SIDE NET START
ST-5	5 26	9 57 +09S	21 ° 58.77 N	142 ° 3.97 E	2452	ORI SIDE NET FINISH
ST-5	5 26	10 3 +09S	21 ° 58.52 N	142 ° 4.16 E	2423	ORI NET START
ST-5	5 26	10 8 +09S	21 ° 58.34 N	142 ° 4.29 E	2400	ORI NET DEEPEST
ST-5	5 26	10 24 +09S	21 ° 57.86 N	142 ° 4.69 E	2297	ORI SIDE NET FINISH
ST-5	5 26	11 15 +09S	21 ° 56.81 N	142 ° 5.69 E	2321	IKMT NET FINISH
ST-5	5 26	11 16 +09S	21 ° 56.79 N	142 ° 5.69 E	2326	ORI NET FINISH
ST-6	5 26	15 17 +09S	20 ° 59.57 N	141 ° 60.00 E	3868	IKMT NET START
ST-6	5 26	15 22 +09S	20 ° 59.46 N	141 ° 60.00 E	3869	ORI SIDE NET START

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-6	5 26	15 42 +09S	20 ° 58.48 N	142 ° 0.01 E	3830	ORI NET FINISH
ST-6	5 26	15 46 +09S	20 ° 58.30 N	142 ° 0.00 E	3827	ORI SIDE NET START
ST-6	5 26	16 7 +09S	20 ° 57.20 N	142 ° 0.03 E	3825	ORI SIDE NET FINISH
ST-6	5 26	16 12 +09S	20 ° 56.96 N	142 ° 0.02 E	3840	IKMT NET DEEPEST
ST-6	5 26	16 54 +09S	20 ° 55.84 N	141 ° 59.80 E	3871	IKMT NET FINISH
ST-7	5 26	20 56 +09S	19 ° 59.92 N	141 ° 59.80 E	4063	CTD START
ST-7	5 26	21 24 +09S	20 ° 0.13 N	141 ° 59.30 E	4057	CTD DEEPEST
ST-7	5 26	21 44 +09S	20 ° 0.35 N	141 ° 58.90 E	4058	CTD FINISHED
ST-7	5 26	21 52 +09S	20 ° 0.38 N	141 ° 58.70 E	4063	IKMT NET START
ST-7	5 26	21 58 +09S	20 ° 0.13 N	141 ° 58.70 E	4065	ORI NET START
ST-7	5 26	22 17 +09S	19 ° 59.52 N	141 ° 58.80 E	4068	ORI SIDE NET FINISH
ST-7	5 26	22 24 +09S	19 ° 59.27 N	141 ° 59.00 E	4070	ORI SIDE NET START
ST-7	5 26	22 40 +09S	19 ° 58.79 N	141 ° 59.20 E	4082	IKMT NET DEEPEST
ST-7	5 26	22 45 +09S	19 ° 58.69 N	141 ° 59.20 E	4091	ORI SIDE NET FINISH
ST-7	5 26	23 31 +09S	19 ° 58.65 N	141 ° 59.20 E	4084	IKMT NET FINISH
ST-8	5 27	3 43 +09S	18 ° 59.93 N	142 ° 0.15 E	4199	CTD-CMS START
ST-8	5 27	4 11 +09S	19 ° 0.11 N	142 ° 0.30 E	4199	CTD DEEPEST
ST-8	5 27	4 30 +09S	19 ° 0.27 N	142 ° 0.24 E	4203	CTD FINISHED
ST-8	5 27	4 44 +09S	19 ° 0.16 N	142 ° 0.57 E	4194	IKMT NET START
ST-8	5 27	4 49 +09S	19 ° 0.12 N	142 ° 0.76 E	4195	ORI NET START
ST-8	5 27	5 10 +09S	18 ° 59.77 N	142 ° 1.72 E	4205	ORI SIDE NET FINISH
ST-8	5 27	5 30 +09S	18 ° 59.45 N	142 ° 2.70 E	4188	IKMT NET DEEPEST
ST-8	5 27	6 20 +09S	18 ° 58.90 N	142 ° 3.97 E	4188	IKMT NET FINISH
ST-9	5 27	10 29 +09S	17 ° 59.34 N	141 ° 59.90 E	4479	CTD START
ST-9	5 27	10 52 +09S	17 ° 59.17 N	141 ° 59.70 E	4470	CTD DEEPEST
ST-9	5 27	11 14 +09S	17 ° 58.99 N	141 ° 59.60 E	4462	CTD FINISHED
ST-9	5 27	11 41 +09S	17 ° 58.78 N	141 ° 59.40 E	4465	START IN SITU PUMP
ST-9	5 27	16 32 +09S	17 ° 57.03 N	141 ° 58.40 E	4473	IN SITU POMP FINISH
ST-9	5 27	16 45 +09S	17 ° 56.81 N	141 ° 58.50 E	4470	IKMT NET START
ST-9	5 27	16 48 +09S	17 ° 56.78 N	141 ° 58.50 E	4470	ORI NET START
ST-9	5 27	17 1 +09S	17 ° 56.52 N	141 ° 58.90 E	4487	IKMT NET DEEPEST
ST-9	5 27	17 19 +09S	17 ° 56.29 N	141 ° 59.20 E	4488	IKMT NET FINISH
ST-9	5 27	17 21 +09S	17 ° 56.27 N	141 ° 59.20 E	4484	ORI NET FINISH
AT-A1	5 27	19 23 +09S	17 ° 29.68 N	142 ° 0.05 E	4463	ARGOS BUOY
ST-10	5 27	21 39 +09S	16 ° 59.98 N	141 ° 59.70 E	4493	CTD START
ST-10	5 27	22 2 +09S	16 ° 59.94 N	141 ° 59.40 E	4490	CTD DEEPEST
ST-10	5 27	22 25 +09S	16 ° 59.85 N	141 ° 59.20 E	4490	CTD FINISHED
ST-10	5 27	22 31 +09S	16 ° 59.87 N	141 ° 59.10 E	4490	IKMT NET START
ST-10	5 27	22 34 +09S	16 ° 59.85 N	141 ° 59.00 E	4490	IKMT NET START
ST-10	5 27	23 18 +09S	16 ° 59.76 N	142 ° 0.88 E	4490	IKMT NET DEEPEST
ST-10	5 27	23 20 +09S	16 ° 59.77 N	142 ° 0.89 E	4490	ORI SIDE NET START
ST-10	5 27	23 40 +09S	16 ° 59.86 N	142 ° 1.30 E	4490	ORI SIDE NET FINISH
ST-10	5 27	23 49 +09S	16 ° 59.89 N	142 ° 1.47 E	4490	ORI SIDE NET START
ST-10	5 28	0 9 +09S	16 ° 59.95 N	142 ° 1.80 E	4490	IKMT NET FINISH
ST-10	5 28	0 12 +09S	16 ° 59.97 N	142 ° 1.88 E	4490	ORI SIDE NET START
ST-10	5 28	0 12 +09S	16 ° 59.97 N	142 ° 1.89 E	4490	ORI SIDE NET FINISH
ST-10	5 28	0 23 +09S	16 ° 59.98 N	142 ° 2.20 E	4490	ORI NET START
ST-10	5 28	0 33 +09S	16 ° 59.98 N	142 ° 2.55 E	4490	ORI NET START
ST-10	5 28	1 15 +09S	17 ° 0.07 N	142 ° 3.81 E	4709	ORI NET DEEPEST
ST-10	5 28	2 26 +09S	17 ° 0.20 N	142 ° 4.69 E	5219	ORI NET FINISH

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-A2	5 28	4 51 +09S	16 ° 30.07 N	142 ° 0.07 E		ALGOS(160M)
ST-A2	5 28	4 54 +09S	16 ° 30.00 N	142 ° 0.01 E	2768	ARGOS(80M)
ST-11	5 28	7 16 +09S	15 ° 59.98 N	142 ° 0.01 E	2574	CTD START
ST-11	5 28	7 28 +09S	16 ° 0.08 N	142 ° 0.04 E		CTD FINISHED
ST-11	5 28	7 57 +09S	16 ° 0.30 N	141 ° 57.70 E	1718	CTD START
ST-11	5 28	8 19 +09S	16 ° 0.37 N	141 ° 57.80 E	4453	CTD DEEPEST
ST-11	5 28	8 40 +09S	16 ° 0.42 N	141 ° 57.70 E	4452	CTD FINISHED
ST-11	5 28	8 54 +09S	16 ° 0.58 N	141 ° 57.50 E	4350	IKMT NET START
ST-11	5 28	8 57 +09S	16 ° 0.64 N	141 ° 57.40 E	4397	ORI SIDE NET START
ST-11	5 28	9 4 +09S	16 ° 0.76 N	141 ° 57.10 E	4448	IKMT NET DEEPEST
ST-11	5 28	9 15 +09S	16 ° 0.90 N	141 ° 56.90 E	4304	ORI SIDE NET FINISH
ST-11	5 28	9 21 +09S	16 ° 0.98 N	141 ° 56.90 E	4453	IKMT NET FINISH
ST-11	5 28	9 32 +09S	16 ° 1.13 N	141 ° 56.80 E	4452	IKMT NET START
ST-11	5 28	9 36 +09S	16 ° 1.19 N	141 ° 57.00 E	4365	ORI SIDE NET START
ST-11	5 28	9 46 +09S	16 ° 1.27 N	141 ° 57.60 E	4455	IKMT NET DEEPEST
ST-11	5 28	9 56 +09S	16 ° 1.39 N	141 ° 58.00 E	4318	ORI SIDE NET FINISH
ST-11	5 28	10 3 +09S	16 ° 1.48 N	141 ° 58.20 E	4435	IKMT NET FINISH
ST-A3	5 28	12 29 +09S	15 ° 30.17 N	142 ° 0.01 E	4135	ARGOS(160M)
ST-A3	5 28	12 32 +09S	15 ° 30.09 N	141 ° 60.00 E	4099	ARGOS(80M)
ST-12	5 28	14 47 +09S	15 ° 0.17 N	142 ° 0.18 E	4432	IKMT NET START
ST-12	5 28	14 52 +09S	15 ° 0.28 N	142 ° 0.44 E	4096	ORI SIDE NET START
ST-12	5 28	15 13 +09S	15 ° 0.84 N	142 ° 1.49 E	4145	ORI SIDE NET FINISH
ST-12	5 28	15 16 +09S	15 ° 0.93 N	142 ° 1.63 E	4192	ORI SIDE NET START
ST-12	5 28	15 36 +09S	15 ° 1.45 N	142 ° 2.61 E	4418	IKMT NET DEEPEST
ST-12	5 28	15 37 +09S	15 ° 1.45 N	142 ° 2.63 E	4418	ORI SIDE NET FINISH
ST-12	5 28	16 21 +09S	15 ° 2.99 N	142 ° 3.36 E	4128	IKMT NET FINISH
ST-12	5 28	16 43 +09S	15 ° 3.56 N	142 ° 3.32 E	4208	CRD-CMS START
ST-12	5 28	18 1 +09S	15 ° 4.55 N	142 ° 3.64 E	4147	CTD-CMS DEEPEST
ST-12	5 28	20 47 +09S	15 ° 6.01 N	142 ° 3.17 E	4215	CTD-CMS FINISH
ST-A4	5 28	23 39 +09S	14 ° 29.91 N	142 ° 0.04 E	4296	ARGOS4 (80M)
ST-A4	5 28	23 43 +09S	14 ° 29.67 N	142 ° 0.06 E	4290	ARGOS4 (160M)
ST-13	5 29	1 48 +09S	14 ° 0.15 N	142 ° 0.04 E	4275	CTD START
ST-13	5 29	2 13 +09S	14 ° 0.34 N	141 ° 59.80 E	4273	CTD DEEPEST
ST-13	5 29	2 36 +09S	14 ° 0.54 N	141 ° 59.50 E	4288	CTD FINISHED
ST-13	5 29	3 4 +09S	14 ° 0.96 N	141 ° 59.50 E	4287	IKMT NET START
ST-13	5 29	3 11 +09S	14 ° 1.05 N	141 ° 59.60 E	4290	ORI NET START
ST-13	5 29	3 19 +09S	14 ° 1.00 N	141 ° 59.90 E	4288	IKMT NET DEEPEST
ST-13	5 29	3 42 +09S	14 ° 0.85 N	142 ° 0.71 E	4272	ORI SIDE NET FINISH
ST-13	5 29	3 53 +09S	14 ° 0.82 N	142 ° 0.84 E	4282	IKMT NET FINISH
ST-A5	5 29	6 20 +09S	13 ° 30.08 N	141 ° 60.00 E	2635	CTD START
ST-A5	5 29	6 45 +09S	13 ° 30.31 N	141 ° 59.80 E	2894	CTD DEEPEST
ST-A5	5 29	7 8 +09S	13 ° 30.49 N	141 ° 59.70 E	2680	CTD FINISHED
ST-A5	5 29	7 12 +09S	13 ° 30.51 N	141 ° 59.70 E	2676	RELEASE OF ARGOS BUOY
ST-14	5 29	16 36 +09S	11 ° 22.16 N	142 ° 35.00 E	6265	CRD-CMS START
ST-14	5 29	18 39 +09S	11 ° 23.16 N	142 ° 35.00 E	9677	CTD-CMS DEEPEST
ST-14	5 29	22 14 +09S	11 ° 24.61 N	142 ° 34.50 E	9800	CTD-CMS FINISH
ST-14	5 29	23 10 +09S	11 ° 20.03 N	142 ° 34.70 E	9670	NISKIN BUTTFLY START
ST-14	5 30	2 41 +09S	11 ° 21.44 N	142 ° 34.20 E	9783	NISKIN BUTTFLY SEND MESS
ST-14	5 30	7 3 +09S	11 ° 22.42 N	142 ° 34.40 E	9796	NISKIN BUTTFLY FINISH
ST-14	5 30	7 36 +09S	11 ° 19.87 N	142 ° 34.80 E	9799	MULTI STARTED

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-14	5 30	10 49 +09S	11 ° 20.18 N	142 ° 35.30 E	9671	MULTI BOTTOM
ST-14	5 30	13 21 +09S	11 ° 20.36 N	142 ° 35.60 E	9702	MULTI ONDECK
ST-14	5 30	13 37 +09S	11 ° 20.40 N	142 ° 35.20 E	9718	VMPS NET START
ST-14	5 30	13 44 +09S	11 ° 20.42 N	142 ° 35.20 E	9761	VMPS NET START
14-V1	5 30	14 13 +09S	11 ° 20.68 N	142 ° 35.00 E	9779	VMPS NET DEEPEST
14-V1	5 30	14 33 +09S	11 ° 20.86 N	142 ° 34.90 E	9748	VMPS NET FINISH
14-V2	5 30	14 46 +09S	11 ° 20.95 N	142 ° 34.70 E	9681	VMPS NET START
14-V2	5 30	15 14 +09S	11 ° 21.25 N	142 ° 34.50 E	9774	VMPS NET DEEPEST
14-V2	5 30	15 35 +09S	11 ° 21.47 N	142 ° 34.40 E	9688	VMPS NET FINISH
ST-15	5 31	11 36 +10S	14 ° 0.03 N	146 ° 59.80 E	9738	CTD-CMS START
ST-15	5 31	12 48 +10S	14 ° 0.50 N	146 ° 59.30 E	8060	CTD-CMS FINISH
ST-15	5 31	13 34 +10S	14 ° 0.76 N	146 ° 59.00 E	8084	CTD-CMS START
ST-15	5 31	13 37 +10S	14 ° 0.77 N	146 ° 59.00 E	8085	CTD-CMS START
ST-15	5 31	15 34 +10S	14 ° 1.57 N	146 ° 58.90 E	8068	CTD-CMS DEEPEST
ST-15	5 31	19 14 +10S	14 ° 2.28 N	146 ° 58.50 E	8078	CTD-CMS FINISH
ST-15	5 31	19 55 +10S	13 ° 59.93 N	147 ° 0.00 E	7851	MULTI START
ST-15	5 31	22 34 +10S	14 ° 0.20 N	147 ° 0.12 E	8483	MULTI HIT BOTTOM
ST-15	6 1	0 42 +10S	14 ° 1.04 N	147 ° 0.30 E	8090	MULTI ONDECK
ST-15	6 1	1 14 +10S	14 ° 1.30 N	146 ° 59.50 E	7823	ORI NET START
ST-15	6 1	1 22 +10S	14 ° 1.38 N	146 ° 59.70 E	7838	ORI SIDE NET START
ST-15	6 1	1 43 +10S	14 ° 1.61 N	147 ° 0.27 E	7971	ORI SIDE NET FINISH
ST-15	6 1	1 55 +10S	14 ° 1.74 N	147 ° 0.64 E	8090	ORI NET DEEPEST
ST-15	6 1	3 2 +10S	14 ° 1.90 N	147 ° 1.87 E	8103	ORI NET FINISH
Leg. 2						
TEST	6 8	23 8 +10S	15 ° 36.29 N	142 ° 45.44 E	1124	DORP BOAT
TEST	6 8	23 31 +10S	15 ° 36.27 N	142 ° 45.39 E	1086	LAUNCH OF JAGO
TEST	6 8	23 57 +10S	15 ° 36.10 N	142 ° 45.02 E	1455	RETRIEVE OF JAGO
TEST	6 9	0 7 +10S	15 ° 36.00 N	142 ° 44.86 E	1585	RETRIEVE OF BOAT
TEST	6 9	3 48 +10S	15 ° 37.50 N	142 ° 45.51 E	126	JAGO TEST
TEST	6 9	4 20 +10S	15 ° 37.43 N	142 ° 45.61 E	840	UNDERWATER OF JAGO
TEST	6 9	6 26 +10S	15 ° 37.55 N	142 ° 45.33 E		POPPING UP OF JAGO
TEST	6 9	6 51 +10S	15 ° 37.86 N	142 ° 45.17 E		RETRIEVE OF JAGO
ST-16	6 9	9 48 +10S	15 ° 38.52 N	142 ° 14.38 E	3274	IKMT NET START
ST-16	6 9	9 55 +10S	15 ° 38.53 N	142 ° 14.52 E	3126	ORI SIDE NET START
ST-16	6 9	10 6 +10S	15 ° 38.68 N	142 ° 14.79 E	3124	IKMT NET DEEPEST
ST-16	6 9	10 16 +10S	15 ° 38.82 N	142 ° 15.00 E	3157	ORI SIDE NET FINISH
ST-16	6 9	10 28 +10S	15 ° 38.99 N	142 ° 15.28 E	3013	IKMT NET FINISH
ST-16	6 9	10 33 +10S	15 ° 39.07 N	142 ° 15.44 E	3021	IKMT NET START
ST-16	6 9	10 35 +10S	15 ° 39.10 N	142 ° 15.49 E	2975	ORI SIDE NET START
ST-16	6 9	10 45 +10S	15 ° 39.24 N	142 ° 15.78 E	2857	IKMT NET DEEPEST
ST-16	6 9	10 56 +10S	15 ° 39.36 N	142 ° 16.05 E	2835	ORI SIDE NET FINISH
ST-16	6 9	11 16 +10S	15 ° 39.63 N	142 ° 16.52 E	2764	IKMT NET FINISH
	6 9	12 40 +10S	15 ° 37.60 N	142 ° 32.14 E	4044	BACK 1 HOUR S.M.T IN JST
ST-17	6 9	13 21 +09S	15 ° 37.52 N	142 ° 38.98 E	3696	IKMT NET START
ST-17	6 9	13 25 +09S	15 ° 37.56 N	142 ° 39.08 E	3699	ORI SIDE NET START
ST-17	6 9	13 45 +09S	15 ° 37.83 N	142 ° 39.67 E	3693	IKMT NET DEEPEST
ST-17	6 9	13 45 +09S	15 ° 37.83 N	142 ° 39.68 E	3623	ORI SIDE NET FINISH
ST-17	6 9	14 14 +09S	15 ° 37.93 N	142 ° 40.59 E	3197	IKMT NET FINISH
ST-17	6 9	14 19 +09S	15 ° 37.94 N	142 ° 40.78 E	3172	IKMT NET START
ST-17	6 9	14 21 +09S	15 ° 37.97 N	142 ° 40.90 E	3127	ORI SIDE NET START

Time is indicated in GMT

Station and Working log

St.	Date		Time			Latitude	Longitude	Depth	Event
ST-17	6	9	14	30	+09S	15 ° 37.95 N	142 ° 41.16 E	3030	IKMT NET DEEPEST
ST-17	6	9	14	42	+09S	15 ° 37.98 N	142 ° 41.53 E	2861	ORI SIDE NET FINISH
ST-17	6	9	15	6	+09S	15 ° 38.05 N	142 ° 42.11 E	2576	IKMT NET FINISH
JAGO1	6	9	23	54	+09S	15 ° 38.01 N	142 ° 45.93 E	64	DROP BOAT (SCI)
JAGO1	6	10	0	15	+09S	15 ° 37.96 N	142 ° 45.97 E	53	DROP BOAT (CRW)
JAGO1	6	10	0	36	+09S	15 ° 38.05 N	142 ° 45.96 E	44	LAUNCH OF JAGO
JAGO1	6	10	0	56	+09S	15 ° 38.02 N	142 ° 45.85 E	44	UNDERWATER OF JAGO
JAGO1	6	10	1	17	+09S	15 ° 38.08 N	142 ° 45.80 E	44	RETRIEVE BOAT(CRW)
JAGO1	6	10	4	0	+09S	15 ° 38.08 N	142 ° 45.52 E	44	POPPING UP OF JAGO
JAGO1	6	10	4	26	+09S	15 ° 37.84 N	142 ° 44.72 E	955	RETRIEVE OF JAGO
JAGO1	6	10	7	4	+09S	15 ° 37.76 N	142 ° 46.54 E	229	DROP'D BOAT(NO.1)
JAGO1	6	10	7	17	+09S	15 ° 37.81 N	142 ° 46.40 E	352	LAUNCH OF JAGO
JAGO1	6	10	7	44	+09S	15 ° 38.01 N	142 ° 46.00 E	559	PICKED UP BOAT(NO.1)
JAGO1	6	10	7	52	+09S	15 ° 38.06 N	142 ° 45.77 E	559	DROP'D BOAT(NO.2)
JAGO1	6	10	8	51	+09S	15 ° 38.14 N	142 ° 46.12 E	559	PICKED UP BOAT(NO.2)
JAGO1	6	10	9	18	+09S	15 ° 37.62 N	142 ° 45.43 E	559	POPPING UP OF JAGO
JAGO1	6	10	9	31	+09S	15 ° 38.00 N	142 ° 45.42 E	559	DROP'D BOAT
JAGO1	6	10	9	52	+09S	15 ° 38.01 N	142 ° 45.40 E	362	RETRIEVE OF JAGO
JAGO1	6	10	9	59	+09S	15 ° 37.99 N	142 ° 45.33 E	492	PICKED UP BOAT
ST-18	6	10	11	7	+09S	15 ° 38.98 N	142 ° 45.20 E	162	IKPT START
ST-18	6	10	11	12	+09S	15 ° 38.90 N	142 ° 45.38 E	1587	ORI SIDE NET START
ST-18	6	10	11	18	+09S	15 ° 38.85 N	142 ° 45.48 E	998	IKPT DEEPEST
ST-18	6	10	11	33	+09S	15 ° 38.68 N	142 ° 45.92 E	762	ORI SIDE NET FINISH
ST-18	6	10	12	5	+09S	15 ° 38.27 N	142 ° 46.98 E	960	IKPT FINISH
ST-19	6	10	12	9	+09S	15 ° 38.15 N	142 ° 47.08 E	1121	IKPT START
ST-19	6	10	12	11	+09S	15 ° 38.08 N	142 ° 47.12 E	1056	ORI SIDE NET START
ST-19	6	10	12	21	+09S	15 ° 37.72 N	142 ° 47.12 E	1153	IKPT DEEPEST
ST-19	6	10	12	31	+09S	15 ° 37.36 N	142 ° 47.03 E	1514	ORI SIDE NET FINISH
ST-19	6	10	13	7	+09S	15 ° 36.09 N	142 ° 47.01 E	2007	IKPT FINISH
ST-20	6	10	13	20	+09S	15 ° 36.48 N	142 ° 46.39 E	2007	IKPT START
ST-20	6	10	13	23	+09S	15 ° 36.46 N	142 ° 46.29 E	2007	ORI SIDE NET START
ST-20	6	10	13	43	+09S	15 ° 36.43 N	142 ° 45.45 E	954	ORI SIDE NET FINISH
ST-20	6	10	13	55	+09S	15 ° 36.39 N	142 ° 44.93 E	1322	IKPT DEEPEST
ST-20	6	10	14	23	+09S	15 ° 36.41 N	142 ° 43.81 E	2164	IKPT FINISH
ST-21	6	10	14	42	+09S	15 ° 37.36 N	142 ° 44.46 E	1441	IKPT START
ST-21	6	10	14	45	+09S	15 ° 37.43 N	142 ° 44.48 E	1468	ORI SIDE NET START
ST-21	6	10	14	57	+09S	15 ° 37.79 N	142 ° 44.46 E	1090	IKPT DEEPEST
ST-21	6	10	15	5	+09S	15 ° 38.03 N	142 ° 44.39 E	1179	ORI SIDE NET FINISH
ST-21	6	10	15	45	+09S	15 ° 39.28 N	142 ° 44.01 E	1938	IKMT NET FINISH
	6	11	1	17	+09S	15 ° 37.47 N	142 ° 45.57 E	74	BUOY (2)
	6	11	1	53	+09S	15 ° 37.63 N	142 ° 45.97 E		LET GO BUOY(EAST)
	6	11	1	56	+09S	15 ° 37.56 N	142 ° 45.95 E	80	PINGER
	6	11	2	11	+09S	15 ° 37.77 N	142 ° 45.59 E	41	LET GO BUOY(WEST)
	6	11	2	13	+09S	15 ° 37.78 N	142 ° 45.60 E	25	LET GO BUOY(WEST)
	6	11	2	34	+09S	15 ° 37.54 N	142 ° 45.99 E	92	DROP BOAT(2)
	6	11	6	30	+09S	15 ° 37.64 N	142 ° 45.31 E		1308 PICK'D UP BOAT(2)
	6	11	6	31	+09S	15 ° 37.64 N	142 ° 45.31 E		1350 DROP'D BOAT(2)
	6	11	6	31	+09S	15 ° 37.64 N	142 ° 45.30 E		1528 PICK'D UP BOAT(2)
JAGO3	6	11	7	52	+09S	15 ° 37.63 N	142 ° 46.36 E	502	DORP'D BOAT(NO.1)
JAGO3	6	11	8	3	+09S	15 ° 37.65 N	142 ° 46.31 E	449	LAUNCH OF JAGO

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Station and Working log

St.	Date		Time			Latitude	Longitude	Depth	Event
JAGO3	6	11	8	9	+09S	15 ° 37.62 N	142 ° 46.21 E	434	UNDERWATER OF JAGO
JAGO3	6	11	8	23	+09S	15 ° 37.60 N	142 ° 46.19 E	434	PICKED UP BOAT(NO.1)
JAGO3	6	11	12	17	+09S	15 ° 37.15 N	142 ° 45.64 E	434	DROP BOAT(1)
JAGO3	6	11	12	21	+09S	15 ° 37.11 N	142 ° 45.57 E	434	RETRIEVE OF JAGO
JAGO3	6	11	12	38	+09S	15 ° 37.05 N	142 ° 45.51 E	519	RETRIEVE OF JAGO
JAGO3	6	11	12	45	+09S	15 ° 37.00 N	142 ° 45.36 E	636	PICK UP BOAT(1)
ST-22	6	11	13	6	+09S	15 ° 37.25 N	142 ° 44.59 E	1184	IKPT START
ST-22	6	11	13	10	+09S	15 ° 37.36 N	142 ° 44.58 E	1091	ORI SIDE NET START
ST-22	6	11	13	20	+09S	15 ° 37.67 N	142 ° 44.52 E	945	IKPT DEEPEST
ST-22	6	11	13	30	+09S	15 ° 37.94 N	142 ° 44.47 E	1492	ORI SIDE NET FINISH
ST-22	6	11	13	59	+09S	15 ° 38.84 N	142 ° 44.42 E	1535	IKPT FINISH
ST-23	6	11	14	12	+09S	15 ° 38.96 N	142 ° 45.17 E	1235	IKPT START
ST-23	6	11	14	15	+09S	15 ° 38.95 N	142 ° 45.22 E	1226	ORI SIDE NET START
ST-23	6	11	14	22	+09S	15 ° 38.98 N	142 ° 45.43 E	1443	IKPT DEEPEST
ST-23	6	11	14	35	+09S	15 ° 39.01 N	142 ° 45.79 E	1054	ORI SIDE NET FINISH
ST-23	6	11	15	2	+09S	15 ° 38.96 N	142 ° 46.50 E	888	IKPT FINISH
ST-24	6	11	15	18	+09S	15 ° 38.29 N	142 ° 47.04 E	948	IKMT NET START
ST-24	6	11	15	21	+09S	15 ° 38.19 N	142 ° 47.02 E	945	ORI SIDE NET START
ST-24	6	11	15	25	+09S	15 ° 38.11 N	142 ° 47.02 E	977	IKMT NET DEEPEST
ST-24	6	11	15	41	+09S	15 ° 37.56 N	142 ° 46.95 E	759	ORI SIDE NET FINISH
ST-24	6	11	16	5	+09S	15 ° 36.80 N	142 ° 46.98 E	1664	IKMT NET FINISH
ST-25	6	11	16	16	+09S	15 ° 36.46 N	142 ° 46.44 E	1628	IKMT NET START
ST-25	6	11	16	19	+09S	15 ° 36.48 N	142 ° 46.24 E	1514	ORI SIDE NET START
ST-25	6	11	16	41	+09S	15 ° 36.48 N	142 ° 45.26 E	2007	ORI SIDE NET FINISH
ST-25	6	11	17	6	+09S	15 ° 36.47 N	142 ° 44.11 E	2007	IKMT NET FINISH
JAGO4	6	11	23	8	+09S	15 ° 37.63 N	142 ° 46.22 E	495	DROP BOAT (2)
JAGO4	6	11	23	14	+09S	15 ° 37.61 N	142 ° 46.16 E	389	DROP BOAT(1)
JAGO4	6	11	23	27	+09S	15 ° 37.75 N	142 ° 46.31 E	428	LAUNCH OF JAGO
JAGO4	6	11	23	38	+09S	15 ° 37.73 N	142 ° 46.17 E	311	UNDERWATER OF JAGO
JAGO4	6	11	23	55	+09S	15 ° 37.59 N	142 ° 46.34 E	379	PICK UP BOAT(1)
JAGO4	6	12	1	51	+09S	15 ° 37.31 N	142 ° 46.04 E	379	DROP BOAT(1)
JAGO4	6	12	1	59	+09S	15 ° 37.26 N	142 ° 45.98 E	379	POPPING UP OF JAGO
JAGO4	6	12	2	20	+09S	15 ° 37.38 N	142 ° 45.72 E	99	RETRIEVE OF JAGO
JAGO4	6	12	2	31	+09S	15 ° 37.28 N	142 ° 45.44 E	386	PICK UP BOAT(1)
JAGO4	6	12	2	57	+09S	15 ° 37.32 N	142 ° 45.50 E	319	PICK UP BOAT(2)
	6	12	5	14	+09S	15 ° 37.56 N	142 ° 46.26 E	368	DROP'D BOAT(2)
	6	12	6	0	+09S	15 ° 37.65 N	142 ° 46.31 E	457	PICK'D BOAT(2)
JAGP5	6	12	8	50	+09S	15 ° 37.62 N	142 ° 46.37 E	509	DORP'D BOAT(NO.1)
JAGP5	6	12	9	0	+09S	15 ° 37.61 N	142 ° 46.19 E	581	LAUNCH OF JAGO
JAGP5	6	12	9	6	+09S	15 ° 37.62 N	142 ° 46.16 E	332	UNDERWATER OF JAGO
JAGP5	6	12	9	16	+09S	15 ° 37.72 N	142 ° 46.30 E	332	PICKED UP BOAT(NO.1)
JAGO5	6	12	12	41	+09S	15 ° 37.24 N	142 ° 45.70 E	332	DROP BOAT(1)
JAGO5	6	12	12	52	+09S	15 ° 37.20 N	142 ° 45.73 E	332	POPPING UP OF JAGO
JAGO5	6	12	13	6	+09S	15 ° 37.27 N	142 ° 45.63 E	332	RETRIEVE OF JAGO
JAGO5	6	12	13	13	+09S	15 ° 37.26 N	142 ° 45.56 E	332	PICK UP BOAT(1)
ST-26	6	12	22	56	+09S	15 ° 36.15 N	142 ° 30.02 E	98	IKMT NET START
ST-26	6	12	23	35	+09S	15 ° 38.08 N	142 ° 29.72 E	1074	IKMT NET DEEPEST
ST-26	6	13	0	46	+09S	15 ° 40.34 N	142 ° 28.21 E	1106	IKMT NET FINISH
TRAK	6	13	2	41	+09S	15 ° 37.30 N	142 ° 46.15 E	382	DROP BOAT(2)
TRAK	6	13	4	39	+09S	15 ° 37.27 N	142 ° 46.09 E	567	PICK'D UP BOAT(2)

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Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
TRAK	6 13	5 17 +09S	15 ° 37.18 N	142 ° 46.09 E	226	DROP'D BOAT(2)
TRAK	6 13	6 13 +09S	15 ° 37.39 N	142 ° 46.13 E	307	PICK'D BOAT(2)
JAGO5	6 13	8 58 +09S	15 ° 38.09 N	142 ° 45.99 E	108	DROP'D BOAT(NO.1)
JAGO5	6 13	9 9 +09S	15 ° 38.08 N	142 ° 45.98 E	99	LAUNCH OF JAGO
JAGO5	6 13	9 13 +09S	15 ° 38.04 N	142 ° 45.97 E	96	UNDERWATER OF JAGO
JAGO5	6 13	9 21 +09S	15 ° 38.07 N	142 ° 46.01 E	99	PICK'D UP BOAT(NO.1)
JAGO5	6 13	13 27 +09S	15 ° 38.22 N	142 ° 46.17 E	99	DROP BOAT(1)
JAGO5	6 13	13 39 +09S	15 ° 38.17 N	142 ° 46.21 E	99	POPPING UP OF JAGO
JAGO5	6 13	13 55 +09S	15 ° 38.07 N	142 ° 46.05 E	99	RETRIEVE OF JAGO
JAGO5	6 13	14 1 +09S	15 ° 38.09 N	142 ° 45.92 E	297	PICK UP BOAT(1)
ST-27	6 13	14 34 +09S	15 ° 37.71 N	142 ° 47.06 E	1328	IKPT DEEPEST
ST-27	6 13	14 48 +09S	15 ° 37.23 N	142 ° 47.14 E	1355	ORI SIDE NET FINISH
ST-27	6 13	15 16 +09S	15 ° 36.28 N	142 ° 47.26 E	2007	IKPT FINISH
ST-28	6 13	15 33 +09S	15 ° 36.57 N	142 ° 46.25 E	2007	IKPT START
ST-28	6 13	15 36 +09S	15 ° 36.57 N	142 ° 46.11 E	2007	ORI SIDE NET START
ST-28	6 13	15 44 +09S	15 ° 36.58 N	142 ° 45.82 E	2007	IKPT DEEPEST
ST-28	6 13	15 56 +09S	15 ° 36.62 N	142 ° 45.33 E	2007	ORI SIDE NET FINISH
ST-28	6 13	16 25 +09S	15 ° 36.75 N	142 ° 44.21 E	2007	IKPT FINISH
ST-29	6 13	16 39 +09S	15 ° 37.26 N	142 ° 44.43 E	2007	IKPT START
ST-29	6 13	16 41 +09S	15 ° 37.36 N	142 ° 44.43 E	2007	ORI SIDE NET START
ST-29	6 13	16 47 +09S	15 ° 37.53 N	142 ° 44.39 E	2007	IKPT DEEPEST
ST-29	6 13	17 1 +09S	15 ° 38.03 N	142 ° 44.31 E	2007	ORI SIDE NET FINISH
ST-29	6 13	17 30 +09S	15 ° 39.16 N	142 ° 44.23 E	2007	IKPT FINISH
ST-30	6 13	17 45 +09S	15 ° 39.00 N	142 ° 45.09 E	2007	IKPT START
ST-30	6 13	17 51 +09S	15 ° 39.03 N	142 ° 45.23 E	2007	ORI SIDE NET START
ST-30	6 13	18 11 +09S	15 ° 39.05 N	142 ° 45.69 E	2007	ORI SIDE NET FINISH
ST-30	6 13	18 41 +09S	15 ° 39.05 N	142 ° 46.27 E	2007	IKPT FINISH
JAGO7	6 13	23 30 +09S	15 ° 37.64 N	142 ° 46.27 E	390	DROP BOAT(2)
JAGO7	6 13	23 34 +09S	15 ° 37.61 N	142 ° 46.21 E	366	DROP BOAT(1)
JAGO7	6 13	23 43 +09S	15 ° 37.61 N	142 ° 46.26 E	422	LAUNCH OF JAGO
JAGO7	6 13	23 51 +09S	15 ° 37.61 N	142 ° 46.19 E	393	UNDERWATER OF JAGO
JAGO7	6 13	23 59 +09S	15 ° 37.61 N	142 ° 46.16 E	393	PICK UP BOAT(1)
JAGO7	6 14	2 2 +09S	15 ° 37.52 N	142 ° 46.25 E	393	DROP BOAT(1)
JAGO7	6 14	2 25 +09S	15 ° 37.35 N	142 ° 46.18 E	393	POPPING UP OF JAGO
JAGO7	6 14	2 53 +09S	15 ° 37.66 N	142 ° 46.00 E	393	RETRIEVE OF JAGO
JAGO7	6 14	2 58 +09S	15 ° 37.60 N	142 ° 46.04 E	393	PICK UP BOAT(1)
	6 14	4 1 +09S	15 ° 37.59 N	142 ° 46.43 E	383	DROP'D BOT(2)
	6 14	4 15 +09S	15 ° 37.50 N	142 ° 46.23 E	424	PICK'D BOAT(1)
	6 14	5 32 +09S	15 ° 37.66 N	142 ° 46.16 E	919	DROP'D BOAT(1)
	6 14	6 15 +09S	15 ° 37.64 N	142 ° 46.27 E	456	PICK'D BOAT(2)
	6 14	6 22 +09S	15 ° 37.61 N	142 ° 46.22 E	453	DROP'D BOAT(2)
	6 14	7 7 +09S	15 ° 37.68 N	142 ° 46.17 E	921	PICK'D UP BOAT(NO.2)
	6 14	7 11 +09S	15 ° 37.70 N	142 ° 46.07 E	1189	PICK'D UP BOAT(1)
JAGO8	6 14	9 0 +09S	15 ° 37.63 N	142 ° 46.24 E	353	DROP'D BOAT(NO.1)
JAGO8	6 14	9 9 +09S	15 ° 37.69 N	142 ° 46.12 E	274	LAUNCH OF JAGO
JAGO8	6 14	9 14 +09S	15 ° 37.67 N	142 ° 46.10 E	247	UNDERWATER OF JAGO
JAGO8	6 14	9 32 +09S	15 ° 37.57 N	142 ° 46.18 E	342	PICK'D UP BOAT(NO.1)
JAGO8	6 14	13 29 +09S	15 ° 37.50 N	142 ° 45.34 E	342	DROP BOAT(1)
JAGO8	6 14	13 32 +09S	15 ° 37.50 N	142 ° 45.32 E	342	POPPING UP OF JAGO
JAGO8	6 14	13 47 +09S	15 ° 37.68 N	142 ° 45.29 E	760	RETRIEVE OF JAGO

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
JAGO8	6 14	13 54 +09S	15 ° 37.76 N	142 ° 45.14 E	905	PICK UP BOAT(1)
ST-31	6 14	16 29 +09S	15 ° 51.16 N	143 ° 14.88 E	898	IKPT START
ST-31	6 14	16 33 +09S	15 ° 51.17 N	143 ° 14.98 E	996	ORI SIDE NET START
ST-31	6 14	16 53 +09S	15 ° 51.28 N	143 ° 15.55 E	1004	ORI SIDE NET FINISH
ST-31	6 14	17 51 +09S	15 ° 51.65 N	143 ° 17.32 E	771	IKPT FINISH
ST-32	6 14	19 11 +09S	16 ° 4.19 N	143 ° 14.89 E	2081	IKPT START
ST-32	6 14	19 15 +09S	16 ° 4.18 N	143 ° 14.99 E	2079	ORI NET START
ST-32	6 14	19 15 +09S	16 ° 4.18 N	143 ° 15.00 E	2080	ORI SIDE NET START
ST-32	6 14	19 27 +09S	16 ° 4.25 N	143 ° 15.40 E	2061	IKPT DEEPEST
ST-32	6 14	19 35 +09S	16 ° 4.28 N	143 ° 15.64 E	2050	ORI SIDE NET FINISH
ST-32	6 14	20 25 +09S	16 ° 4.45 N	143 ° 17.15 E	1964	IKMT NET FINISH
ST-33	6 14	21 48 +09S	16 ° 17.65 N	143 ° 14.84 E	2592	IKMT NET START
ST-33	6 14	21 51 +09S	16 ° 17.66 N	143 ° 14.89 E	2585	ORI SIDE NET START
ST-33	6 14	22 1 +09S	16 ° 17.66 N	143 ° 15.26 E	2554	IKPT DEEPEST
ST-33	6 14	22 12 +09S	16 ° 17.70 N	143 ° 15.62 E	2529	ORI SIDE NET FINISH
ST-33	6 14	22 44 +09S	16 ° 17.76 N	143 ° 16.73 E	2527	IKPT FINISH
	6 15	1 40 +09S	16 ° 30.13 N	143 ° 9.43 E	23	LET GO (LIGHT+YELLOW FLAG)
	6 15	2 2 +09S	16 ° 30.01 N	143 ° 8.83 E	46	LET GO BUOY(YELLOW 2)
	6 15	2 22 +09S	16 ° 29.75 N	143 ° 9.06 E	47	LET GO BUOY(RED FLAG)
JAGO9	6 15	8 59 +09S	16 ° 30.07 N	143 ° 9.81 E	251	DROP'D BOAT(NO.1)
JAGO9	6 15	9 19 +09S	16 ° 30.16 N	143 ° 9.63 E	149	LAUNCH OF JAGO
JAGO9	6 15	9 24 +09S	16 ° 30.18 N	143 ° 9.64 E	129	UNDERWATER OF JAGO
JAGO9	6 15	9 37 +09S	16 ° 30.18 N	143 ° 9.78 E	109	PICK'D UP BOAT(NO.1)
JAGO9	6 15	13 31 +09S	16 ° 30.21 N	143 ° 9.73 E	109	DROP BOAT(1)
JAGO9	6 15	13 37 +09S	16 ° 30.22 N	143 ° 9.76 E	109	POPPING UP OF JAGO
JAGO9	6 15	13 59 +09S	16 ° 30.27 N	143 ° 9.80 E	545	RETRIEVE OF JAGO
JAGO9	6 15	14 6 +09S	16 ° 30.36 N	143 ° 9.68 E	846	PICK UP BOAT(1)
CTD1	6 15	14 41 +09S	16 ° 31.06 N	143 ° 7.99 E	1193	CTD START
CTD1	6 15	15 7 +09S	16 ° 31.36 N	143 ° 8.04 E	1352	CTD DEEPEST
CTD1	6 15	15 40 +09S	16 ° 31.71 N	143 ° 8.07 E	1526	CTD FINISHED
JA-10	6 15	23 24 +09S	16 ° 30.09 N	143 ° 9.82 E	813	DROP BOAT(2)
JA-10	6 15	23 29 +09S	16 ° 30.09 N	143 ° 9.77 E	935	DROP BOAT(1)
JA-10	6 15	23 40 +09S	16 ° 30.12 N	143 ° 9.78 E	1203	LAUNCH OF JAGO
JA-10	6 15	23 48 +09S	16 ° 30.10 N	143 ° 9.68 E	1344	UNDERWATER OF JAGO
JA-10	6 15	23 59 +09S	16 ° 30.12 N	143 ° 9.79 E	1395	PICK UP BOAT(1)
JA-10	6 16	1 40 +09S	16 ° 30.28 N	143 ° 9.74 E	1395	DROP BOAT(1)
JA-10	6 16	1 47 +09S	16 ° 30.30 N	143 ° 9.74 E	1395	POPPING UP OF JAGO
JA-10	6 16	2 0 +09S	16 ° 30.34 N	143 ° 9.73 E	1395	RETRIEVE OF JAGO
JA-10	6 16	2 7 +09S	16 ° 30.36 N	143 ° 9.62 E	1395	PICK UP BOAT(1)
JA-10	6 16	2 34 +09S	16 ° 29.73 N	143 ° 9.59 E	1395	PICK UP BOAT(2)
TRAC2	6 16	3 21 +09S	16 ° 29.60 N	143 ° 9.78 E	1395	DROP'D BOAT(2)
TRAC2	6 16	4 55 +09S	16 ° 29.69 N	143 ° 9.73 E	702	DROP'D BOAT(1)
TRAC2	6 16	5 1 +09S	16 ° 29.65 N	143 ° 9.66 E	904	PICK'D UP BOAT(2)
TRAC2	6 16	6 26 +09S	16 ° 29.60 N	143 ° 9.69 E	877	PICK'D UP BOAT(1)
JA-11	6 16	9 0 +09S	16 ° 29.99 N	143 ° 8.61 E	270	DROP'D BOAT (NO.1)
JA-11	6 16	9 10 +09S	16 ° 30.04 N	143 ° 8.68 E	179	LAUNCH OF JAGO
JA-11	6 16	9 20 +09S	16 ° 30.00 N	143 ° 8.56 E	167	UNDERWATER OF JAGO
JA-11	6 16	9 29 +09S	16 ° 29.96 N	143 ° 8.43 E	167	PICK'D UP BOAT (NO.1)
JA-11	6 16	13 33 +09S	16 ° 29.41 N	143 ° 9.07 E	167	DROP BOAT(1)
JA-11	6 16	13 39 +09S	16 ° 29.42 N	143 ° 9.01 E	167	POPPING UP OF JAGO

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
JA-11	6 16	13 56 +09S	16 ° 29.50 N	143 ° 8.86 E	320	RETRIEVE OF JAGO
JA-11	6 16	14 2 +09S	16 ° 29.56 N	143 ° 8.74 E	486	PICK UP BOAT (1)
ST-34	6 16	14 20 +09S	16 ° 29.46 N	143 ° 8.21 E	804	IKPT START
ST-34	6 16	14 23 +09S	16 ° 29.59 N	143 ° 8.19 E	754	ORI SIDE NET START
ST-34	6 16	14 36 +09S	16 ° 30.14 N	143 ° 8.07 E	738	IKPT DEEPEST
ST-34	6 16	14 42 +09S	16 ° 30.36 N	143 ° 8.06 E	813	ORI SIDE NET FINISH
ST-34	6 16	15 23 +09S	16 ° 31.93 N	143 ° 7.87 E	1723	IKPT FINISH
ST-35	6 16	15 51 +09S	16 ° 30.74 N	143 ° 8.54 E	776	IKPT START
ST-35	6 16	15 55 +09S	16 ° 30.74 N	143 ° 8.70 E	1051	ORI SIDE NET START
ST-35	6 16	16 12 +09S	16 ° 30.78 N	143 ° 9.43 E	1472	IKPT DEEPEST
ST-35	6 16	16 14 +09S	16 ° 30.78 N	143 ° 9.54 E	1774	ORI SIDE NET FINISH
ST-35	6 16	16 59 +09S	16 ° 30.74 N	143 ° 11.32 E	2007	IKPT FINISH
ST-36	6 16	17 23 +09S	16 ° 30.71 N	143 ° 10.04 E	2007	IKPT START
ST-36	6 16	17 26 +09S	16 ° 30.59 N	143 ° 10.05 E	2007	ORI SIDE NET START
ST-36	6 16	17 40 +09S	16 ° 30.09 N	143 ° 10.15 E	2007	IKPT DEEPEST
ST-36	6 16	17 47 +09S	16 ° 29.90 N	143 ° 10.17 E	2007	ORI SIDE NET FINISH
ST-36	6 16	18 27 +09S	16 ° 28.53 N	143 ° 10.36 E	2007	IKPT FINISH
ST-37	6 16	18 50 +09S	16 ° 29.24 N	143 ° 9.68 E	2007	IKPT START
ST-37	6 16	18 54 +09S	16 ° 29.23 N	143 ° 9.51 E	2007	ORI SIDE NET START
ST-37	6 16	19 7 +09S	16 ° 29.23 N	143 ° 9.10 E	2007	IKPT DEEPEST
ST-37	6 16	19 15 +09S	16 ° 29.20 N	143 ° 8.81 E	2007	ORI SIDE NET FINISH
ST-37	6 16	19 57 +09S	16 ° 29.17 N	143 ° 7.51 E	2007	IKPT FINISH
TRAC3	6 16	23 14 +09S	16 ° 29.32 N	143 ° 8.87 E	579	DROP BOAT(2)
TRAC3	6 17	0 50 +09S	16 ° 29.45 N	143 ° 8.79 E	534	PICK UP BOAT(2)
TRAC3	6 17	1 18 +09S	16 ° 29.56 N	143 ° 9.15 E	332	DROP BOAT(2)
TRAC3	6 17	1 23 +09S	16 ° 29.58 N	143 ° 9.03 E	392	DROP BOAT(1)
TRAC3	6 17	1 54 +09S	16 ° 29.54 N	143 ° 8.92 E	324	PICK UP BOAT (1)
TRAC3	6 17	2 23 +09S	16 ° 29.54 N	143 ° 8.84 E	1188	PICK UP BOAT(2)
TRAC3	6 17	6 4 +09S	16 ° 29.59 N	143 ° 8.95 E	254	DROP'D BOAT(2)
TRAC3	6 17	7 5 +09S	16 ° 29.57 N	143 ° 8.73 E	284	PICK'D UP BOAT(2)
JA-12	6 17	9 29 +09S	16 ° 30.46 N	143 ° 9.04 E	169	DROP'D BOAT (NO.1)
JA-12	6 17	9 44 +09S	16 ° 30.41 N	143 ° 9.09 E	237	LAUNCH OF JAGO
JA-12	6 17	9 50 +09S	16 ° 30.44 N	143 ° 9.08 E	292	UNDERWATER OF JAGO
JA-12	6 17	9 55 +09S	16 ° 30.43 N	143 ° 9.10 E	292	PICK'D UP BOAT (NO.1)
JA-12	6 17	13 22 +09S	16 ° 30.11 N	143 ° 8.59 E	292	DROP BOAT(1)
JA-12	6 17	13 29 +09S	16 ° 30.12 N	143 ° 8.51 E	292	POPPING UP OF JAGO
JA-12	6 17	13 48 +09S	16 ° 30.19 N	143 ° 8.58 E	292	RETRIEVE OF JAGO
JA-12	6 17	13 54 +09S	16 ° 30.20 N	143 ° 8.49 E	292	PICK UP BOAT(1)
JA-13	6 17	23 49 +09S	15 ° 37.43 N	142 ° 45.39 E	111	DROP BOAT(1)
JA-13	6 17	23 51 +09S	15 ° 37.44 N	142 ° 45.40 E	120	DROP BOAT(2)
JA-13	6 18	0 12 +09S	15 ° 37.50 N	142 ° 45.52 E	84	LAUNCH OF JAGO
JA-13	6 18	0 26 +09S	15 ° 37.52 N	142 ° 45.30 E	84	UNDERWATER OF JAGO
JA-13	6 18	0 42 +09S	15 ° 37.45 N	142 ° 45.47 E	84	PICK UP BOAT (1)
JA-13	6 18	2 17 +09S	15 ° 37.58 N	142 ° 45.24 E	84	DROP BOAT(1)
JA-13	6 18	2 24 +09S	15 ° 37.60 N	142 ° 45.18 E	84	POPPING UP OF JAGO
JA-13	6 18	2 41 +09S	15 ° 37.90 N	142 ° 45.39 E	84	RETRIEVE OF JAGO
JA-13	6 18	2 46 +09S	15 ° 37.94 N	142 ° 45.24 E	84	PICK UP BOAT(1)
TRAC4	6 18	4 26 +09S	15 ° 38.94 N	142 ° 44.97 E	84	DROP'D BOAT(1)
TRAC4	6 18	4 43 +09S	15 ° 38.81 N	142 ° 44.96 E	84	PICK'D UP BOAT(1)
TRAC4	6 18	5 28 +09S	15 ° 38.59 N	142 ° 44.56 E	84	DROP'D BOAT(1)

Time is indicated in GMT

Station and Working log

St.	Date		Time			Latitude	Longitude	Depth	Event
TRAC4	6	18	6	5	+09S	15 ° 38.38 N	142 ° 44.31 E	84	PICK'D BOT(1)
TRAC4	6	18	6	51	+09S	15 ° 37.55 N	142 ° 46.36 E	516	DROP'D BOAT(1)
TRAC4	6	18	7	48	+09S	15 ° 37.65 N	142 ° 46.30 E	442	PICK'D UP BOAT(NO.1)
JA-14	6	18	8	58	+09S	15 ° 37.35 N	142 ° 45.95 E	557	DROP'D BOAT(NO.1)
JA-14	6	18	9	13	+09S	15 ° 37.35 N	142 ° 45.98 E	258	LAUNCH OF JAGO
JA-14	6	18	9	15	+09S	15 ° 37.35 N	142 ° 45.94 E	236	UNDERWATER OF JAGO
JA-14	6	18	9	18	+09S	15 ° 37.35 N	142 ° 45.90 E	202	PICK'D UP BOAT(NO.2)
JA-14	6	18	9	32	+09S	15 ° 37.23 N	142 ° 45.91 E	222	PICK'D UP BOAT (NO.1)
JA-14	6	18	13	40	+09S	15 ° 38.05 N	142 ° 45.51 E	222	DROP BOAT(1)
JA-14	6	18	13	48	+09S	15 ° 38.03 N	142 ° 45.42 E	222	POPPING UP OF JAGO
JA-14	6	18	14	8	+09S	15 ° 38.04 N	142 ° 45.39 E	222	RETRIEVE OF JAGO
JA-14	6	18	14	14	+09S	15 ° 38.04 N	142 ° 45.24 E	588	PICK UP BOAT(1)
ST-38	6	18	14	30	+09S	15 ° 38.99 N	142 ° 45.12 E	899	IKPT START
ST-38	6	18	14	34	+09S	15 ° 38.98 N	142 ° 45.25 E	894	ORI SIDE NET START
ST-38	6	18	14	47	+09S	15 ° 38.96 N	142 ° 45.58 E	1248	IKPT DEEPEST
ST-38	6	18	14	55	+09S	15 ° 38.96 N	142 ° 45.79 E	1822	ORI SIDE NET FINISH
ST-38	6	18	15	27	+09S	15 ° 38.95 N	142 ° 46.67 E	1631	IKPT FINISH
ST-39	6	18	15	40	+09S	15 ° 38.35 N	142 ° 47.01 E	2204	IKMT NET START
ST-39	6	18	15	44	+09S	15 ° 38.24 N	142 ° 47.02 E	2259	ORI SIDE NET START
ST-39	6	18	16	4	+09S	15 ° 37.61 N	142 ° 47.01 E	1615	ORI SIDE NET FINISH
ST-39	6	18	16	6	+09S	15 ° 37.54 N	142 ° 47.03 E	1586	IKPT DEEPEST
ST-39	6	18	16	48	+09S	15 ° 36.19 N	142 ° 47.04 E	1831	IKPT FINISH
ST-40	6	18	17	7	+09S	15 ° 36.59 N	142 ° 46.35 E	1931	IKPT START
ST-40	6	18	17	10	+09S	15 ° 36.59 N	142 ° 46.23 E	1993	ORI SIDE NET START
ST-40	6	18	17	28	+09S	15 ° 36.60 N	142 ° 45.44 E	2007	IKPT DEEPEST
ST-40	6	18	17	30	+09S	15 ° 36.60 N	142 ° 45.33 E	2013	ORI SIDE NET FINISH
ST-40	6	18	18	8	+09S	15 ° 36.70 N	142 ° 43.73 E	3909	IKPT FINISH
ST-41	6	18	18	29	+09S	15 ° 37.22 N	142 ° 44.44 E	4035	IKPT START
ST-41	6	18	18	33	+09S	15 ° 37.38 N	142 ° 44.42 E	4170	ORI SIDE NET START
ST-41	6	18	18	53	+09S	15 ° 38.04 N	142 ° 44.22 E	3879	ORI SIDE NET FINISH
ST-41	6	18	18	55	+09S	15 ° 38.11 N	142 ° 44.18 E	3929	IKPT DEEPEST
ST-41	6	18	19	41	+09S	15 ° 39.65 N	142 ° 43.16 E	4491	IKPT FINISH
	6	18	23	2	+09S	15 ° 38.09 N	142 ° 45.70 E	324	DROP'D BOAT(NO.2)
	6	19	0	14	+09S	15 ° 37.63 N	142 ° 46.13 E	315	PICK UP BOAT(1)
	6	19	4	31	+09S	16 ° 30.02 N	143 ° 8.64 E	2579	SOUNDING
	6	19	4	47	+09S	16 ° 30.00 N	143 ° 9.46 E	2652	FINISH
	6	19	6	3	+09S	16 ° 29.37 N	143 ° 9.23 E	120	DROP'D BOAT(2)
	6	19	6	9	+09S	16 ° 29.36 N	143 ° 9.12 E	75	DROP'D BOAT(1)
	6	19	6	46	+09S	16 ° 29.63 N	143 ° 9.05 E	118	PICK'D UP BOAT(1)
	6	19	6	48	+09S	16 ° 29.64 N	143 ° 9.02 E	126	DROP'D BOAT (2)
	6	19	7	22	+09S	16 ° 29.79 N	143 ° 8.75 E	79	COM'CED EEL SAMPLING
JA-15	6	19	8	59	+09S	16 ° 29.63 N	143 ° 9.37 E	226	DROP'D BOAT (NO.1)
JA-15	6	19	9	8	+09S	16 ° 29.62 N	143 ° 9.38 E	118	LAUNCH OF JAGO
JA-15	6	19	9	19	+09S	16 ° 29.59 N	143 ° 9.24 E	124	UNDERWATER OF JAGO
JA-15	6	19	9	28	+09S	16 ° 29.61 N	143 ° 9.29 E	124	PICK'D UP BOAT (NO.1)
JA-15	6	19	13	36	+09S	16 ° 30.02 N	143 ° 8.50 E	124	DROP BOAT(1)
JA-15	6	19	13	41	+09S	16 ° 30.05 N	143 ° 8.43 E	124	POPPING UP OF JAGO
JA-15	6	19	13	59	+09S	16 ° 30.12 N	143 ° 8.56 E	124	RETRIEVE OF JAGO
JA-15	6	19	14	7	+09S	16 ° 30.17 N	143 ° 8.42 E	124	PICK UP BOAT(1)
ST-42	6	19	14	57	+09S	16 ° 33.02 N	143 ° 8.35 E	2058	IKPT START

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-42	6 19	15 2 +09S	16 ° 33.05 N	143 ° 8.49 E	2049	ORI SIDE NET START
ST-42	6 19	15 21 +09S	16 ° 33.13 N	143 ° 9.25 E	1968	ORI SIDE NET FINISH
ST-42	6 19	16 35 +09S	16 ° 33.11 N	143 ° 12.13 E	1697	IKPT FINISH
ST-43	6 19	17 0 +09S	16 ° 30.61 N	143 ° 12.15 E	1324	IKPT START
ST-43	6 19	17 4 +09S	16 ° 30.50 N	143 ° 12.21 E	1323	ORI SIDE NET START
ST-43	6 19	17 24 +09S	16 ° 29.87 N	143 ° 12.46 E	1262	ORI SIDE NET FINISH
ST-43	6 19	18 11 +09S	16 ° 28.46 N	143 ° 13.01 E	3658	IKPT FINISH
ST-44	6 19	18 43 +09S	16 ° 26.88 N	143 ° 9.68 E	5067	IKPT START
ST-44	6 19	18 46 +09S	16 ° 26.88 N	143 ° 9.57 E	5068	ORI SIDE NET START
ST-44	6 19	19 5 +09S	16 ° 26.82 N	143 ° 8.98 E	5048	IKPT DEEPEST
ST-44	6 19	19 6 +09S	16 ° 26.82 N	143 ° 8.97 E	5048	ORI SIDE NET FINISH
ST-44	6 19	20 0 +09S	16 ° 26.84 N	143 ° 7.37 E	5142	IKPT FINISH
ST-45	6 19	20 38 +09S	16 ° 29.34 N	143 ° 6.11 E	4978	ORI SIDE NET START
ST-45	6 19	20 53 +09S	16 ° 29.70 N	143 ° 5.85 E	5029	IKPT DEEPEST
ST-45	6 19	20 58 +09S	16 ° 29.82 N	143 ° 5.73 E	5057	ORI SIDE NET FINISH
ST-45	6 19	21 48 +09S	16 ° 30.88 N	143 ° 4.84 E	2219	IKPT FINISH
	6 20	5 17 +09S	16 ° 29.43 N	143 ° 9.08 E	90	DROP'D BOAT(1)
	6 20	5 34 +09S	16 ° 29.29 N	143 ° 8.78 E	130	PICK'D UP BOAT(1)
	6 20	5 48 +09S	16 ° 29.08 N	143 ° 8.89 E	108	EEL SAMPLING FINISH
	6 20	6 55 +09S	16 ° 29.46 N	143 ° 9.07 E	170	EEL SAMPLING FINISH
JA-16	6 20	9 1 +09S	16 ° 29.84 N	143 ° 9.55 E	340	DROP'D BOAT (NO.1)
JA-16	6 20	9 10 +09S	16 ° 29.85 N	143 ° 9.39 E	270	LAUNCH OF JAGO
JA-16	6 20	9 17 +09S	16 ° 29.85 N	143 ° 9.45 E	274	UNDERWATER OF JAGO
JA-16	6 20	9 25 +09S	16 ° 29.79 N	143 ° 9.53 E	274	PICK'D UP BOAT (NO.1)
JA-16	6 20	13 39 +09S	16 ° 30.50 N	143 ° 9.05 E	274	DROP BOAT(1)
JA-16	6 20	13 43 +09S	16 ° 30.49 N	143 ° 9.04 E	274	POPPING UP OF JAGO
JA-16	6 20	13 57 +09S	16 ° 30.57 N	143 ° 9.15 E	274	RETRIEVE OF JAGO
JA-16	6 20	14 4 +09S	16 ° 30.56 N	143 ° 9.09 E	274	PICK UP BOAT(1)
ST-46	6 20	14 59 +09S	16 ° 29.34 N	143 ° 9.66 E	738	IKPT START
ST-46	6 20	15 4 +09S	16 ° 29.33 N	143 ° 9.48 E	659	ORI SIDE NET START
ST-46	6 20	15 24 +09S	16 ° 29.33 N	143 ° 8.83 E	1259	ORI SIDE NET FINISH
ST-46	6 20	16 3 +09S	16 ° 29.35 N	143 ° 7.60 E	1968	IKPT FINISH
ST-47	6 20	16 21 +09S	16 ° 29.30 N	143 ° 8.32 E	1466	IKPT START
ST-47	6 20	16 24 +09S	16 ° 29.39 N	143 ° 8.30 E	1477	ORI SIDE NET START
ST-47	6 20	16 44 +09S	16 ° 30.13 N	143 ° 8.09 E	1502	ORI SIDE NET FINISH
ST-47	6 20	17 26 +09S	16 ° 31.48 N	143 ° 7.65 E	3069	IKPT FINISH
ST-48	6 20	17 45 +09S	16 ° 30.71 N	143 ° 8.41 E	2355	IKPT START
ST-48	6 20	17 48 +09S	16 ° 30.71 N	143 ° 8.52 E	2553	ORI SIDE NET START
ST-48	6 20	18 8 +09S	16 ° 30.65 N	143 ° 9.33 E	2257	ORI SIDE NET FINISH
ST-48	6 20	18 51 +09S	16 ° 30.53 N	143 ° 11.02 E	2139	IKPT FINISH
ST-49	6 20	19 15 +09S	16 ° 30.69 N	143 ° 9.93 E	2068	IKPT START
ST-49	6 20	19 17 +09S	16 ° 30.62 N	143 ° 9.94 E	2036	ORI SIDE NET START
ST-49	6 20	19 31 +09S	16 ° 30.02 N	143 ° 9.88 E	2082	IKPT DEEPEST
ST-49	6 20	19 37 +09S	16 ° 29.83 N	143 ° 9.86 E	1887	ORI SIDE NET FINISH
ST-49	6 20	20 20 +09S	16 ° 28.20 N	143 ° 9.68 E	2755	IKPT FINISH
JA-17	6 21	8 57 +09S	16 ° 30.44 N	143 ° 9.26 E	1064	DROP'D BOAT (NO.2)
JA-17	6 21	9 3 +09S	16 ° 30.40 N	143 ° 9.26 E	217	DROP'D BOAT (NO.1)
JA-17	6 21	9 11 +09S	16 ° 30.40 N	143 ° 9.27 E	262	LAUNCH OF JAGO
JA-17	6 21	9 17 +09S	16 ° 30.41 N	143 ° 9.30 E	214	UNDERWATER OF JAGO
JA-17	6 21	9 30 +09S	16 ° 30.38 N	143 ° 9.43 E	232	PICK'D UP BOAT (NO.1)

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
JA-17	6 21	9 35 +09S	16 ° 30.36 N	143 ° 9.38 E	232	PICK'D UP BOAT (NO.2)
JA-17	6 21	13 35 +09S	16 ° 29.69 N	143 ° 8.73 E	232	DROP BOAT(1)
JA-17	6 21	13 45 +09S	16 ° 29.65 N	143 ° 8.69 E	232	POPPING UP OF JAGO
JA-17	6 21	14 0 +09S	16 ° 29.53 N	143 ° 8.79 E	232	RETRIEVE OF JAGO
JA-17	6 21	14 6 +09S	16 ° 29.52 N	143 ° 8.77 E	232	PICK UP BOAT(1)
ST-50	6 21	14 59 +09S	16 ° 30.72 N	143 ° 7.45 E	1320	IKPT START
ST-50	6 21	15 4 +09S	16 ° 30.70 N	143 ° 7.70 E	1109	ORI SIDE NET START
ST-50	6 21	15 28 +09S	16 ° 30.71 N	143 ° 8.64 E	1026	IKPT DEEPEST
ST-50	6 21	15 35 +09S	16 ° 30.70 N	143 ° 8.90 E	1058	ORI SIDE NET FINISH
ST-50	6 21	16 37 +09S	16 ° 30.79 N	143 ° 11.26 E	1076	IKPT FINISH
ST-51	6 21	17 6 +09S	16 ° 31.33 N	143 ° 10.05 E	1295	IKPT START
ST-51	6 21	17 9 +09S	16 ° 31.21 N	143 ° 10.05 E	1006	ORI SIDE NET START
ST-51	6 21	17 29 +09S	16 ° 30.56 N	143 ° 10.01 E	1177	IKPT DEEPEST
ST-51	6 21	17 39 +09S	16 ° 30.30 N	143 ° 9.94 E	1316	ORI SIDE NET FINISH
ST-51	6 21	18 40 +09S	16 ° 28.33 N	143 ° 9.94 E	1329	IKPT FINISH
ST-52	6 21	19 2 +09S	16 ° 29.27 N	143 ° 10.61 E	1211	IKPT START
ST-52	6 21	19 4 +09S	16 ° 29.26 N	143 ° 10.57 E	1207	ORI SIDE NET START
ST-52	6 21	19 24 +09S	16 ° 29.25 N	143 ° 10.01 E	1282	IKPT DEEPEST
ST-52	6 21	19 34 +09S	16 ° 29.26 N	143 ° 9.75 E	1102	ORI SIDE NET FINISH
ST-52	6 21	20 29 +09S	16 ° 29.04 N	143 ° 8.31 E	1204	IKPT FINISH
JA-18	6 21	23 13 +09S	16 ° 29.80 N	143 ° 9.38 E	2819	DROP BOAT(1)
JA-18	6 21	23 22 +09S	16 ° 29.79 N	143 ° 9.41 E	2819	LAUNCH OF JAGO
JA-18	6 21	23 29 +09S	16 ° 29.78 N	143 ° 9.50 E	2819	UNDERWATER OF JAGO
JA-18	6 21	23 57 +09S	16 ° 29.66 N	143 ° 9.42 E	2819	PICK UP BOAT(1)
JA-18	6 22	2 10 +09S	16 ° 29.64 N	143 ° 8.59 E	2819	DROP BOAT(1)
JA-18	6 22	2 17 +09S	16 ° 29.57 N	143 ° 8.63 E	2819	POPPING UP OF JAGO
JA-18	6 22	2 34 +09S	16 ° 29.30 N	143 ° 8.90 E	2819	RETRIEVE OF JAGO
JA-18	6 22	2 40 +09S	16 ° 29.22 N	143 ° 8.92 E	2819	PICK UP BOAT(1)
JA-19	6 22	7 52 +09S	15 ° 37.49 N	142 ° 46.03 E	262	DROP'D BOAT (NO.1)
JA-19	6 22	8 1 +09S	15 ° 37.48 N	142 ° 46.01 E	127	LAUNCH OF JAGO
JA-19	6 22	8 8 +09S	15 ° 37.49 N	142 ° 46.01 E	140	UNDERWATER OF JAGO
JA-19	6 22	8 21 +09S	15 ° 37.38 N	142 ° 46.14 E	254	PICK'D UP BOAT (NO.1)
JA-19	6 22	11 35 +09S	15 ° 37.70 N	142 ° 45.18 E	254	DROP BOAT(1)
JA-19	6 22	11 39 +09S	15 ° 37.70 N	142 ° 45.13 E	254	POPPING UP OF JAGO
JA-19	6 22	11 58 +09S	15 ° 37.62 N	142 ° 45.33 E	254	RETRIEVE OF JAGO
JA-19	6 22	12 4 +09S	15 ° 37.60 N	142 ° 45.31 E	254	PICK UP BOAT(1)
ST-53	6 22	12 28 +09S	15 ° 38.85 N	142 ° 44.61 E	1399	IKPT START
ST-53	6 22	12 31 +09S	15 ° 38.84 N	142 ° 44.74 E	1325	ORI SIDE NET START
ST-53	6 22	12 48 +09S	15 ° 38.75 N	142 ° 45.28 E	1635	IKPT DEEPEST
ST-53	6 22	12 51 +09S	15 ° 38.74 N	142 ° 45.37 E	1635	ORI SIDE NET FINISH
ST-53	6 22	13 29 +09S	15 ° 38.71 N	142 ° 46.43 E	684	IKPT FINISH
ST-54	6 22	13 39 +09S	15 ° 38.89 N	142 ° 46.70 E	885	IKPT START
ST-54	6 22	13 40 +09S	15 ° 38.82 N	142 ° 46.69 E	835	ORI SIDE NET START
ST-54	6 22	14 0 +09S	15 ° 38.09 N	142 ° 46.64 E	675	IKPT DEEPEST
ST-54	6 22	14 1 +09S	15 ° 38.08 N	142 ° 46.64 E	632	ORI SIDE NET FINISH
ST-54	6 22	14 43 +09S	15 ° 36.60 N	142 ° 46.49 E	1242	IKPT FINISH
ST-55	6 22	14 55 +09S	15 ° 36.62 N	142 ° 46.78 E	1354	IKPT START
ST-55	6 22	15 16 +09S	15 ° 36.67 N	142 ° 45.78 E	1700	ORI SIDE NET START
ST-55	6 22	15 17 +09S	15 ° 36.67 N	142 ° 45.73 E	1674	IKPT DEEPEST
ST-55	6 22	15 48 +09S	15 ° 36.83 N	142 ° 44.47 E	2007	ORI SIDE NET FINISH

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-55	6 22	16 18 +09S	15 ° 36.97 N	142 ° 43.19 E	2007	IKPT FINISH
ST-56	6 22	16 40 +09S	15 ° 36.50 N	142 ° 44.50 E	2007	IKPT START
ST-56	6 22	17 0 +09S	15 ° 37.23 N	142 ° 44.43 E	2007	ORI SIDE NET START
ST-56	6 22	17 6 +09S	15 ° 37.46 N	142 ° 44.39 E	2007	IKPT DEEPEST
ST-56	6 22	17 20 +09S	15 ° 37.92 N	142 ° 44.29 E	2007	ORI SIDE NET FINISH
ST-56	6 22	17 46 +09S	15 ° 38.96 N	142 ° 44.06 E	2007	IKPT FINISH
JA-20	6 22	23 3 +09S	16 ° 30.30 N	143 ° 9.44 E	2256	DROP'D BOAT (NO.1)
JA-20	6 22	23 11 +09S	16 ° 30.29 N	143 ° 9.48 E	2256	LAUNCH OF JAGO
JA-20	6 22	23 17 +09S	16 ° 30.29 N	143 ° 9.55 E	2256	UNDERWATER OF JAGO
JA-20	6 22	23 38 +09S	16 ° 30.26 N	143 ° 9.74 E	2256	PICK UP BOAT(1)
JA-20	6 23	2 31 +09S	16 ° 30.18 N	143 ° 9.74 E	2256	DROP BOAT(1)
JA-20	6 23	2 36 +09S	16 ° 30.13 N	143 ° 9.75 E	2256	POPPING UP OF JAGO
JA-20	6 23	2 48 +09S	16 ° 30.08 N	143 ° 9.89 E	2256	RETRIEVE OF JAGO
JA-20	6 23	2 53 +09S	16 ° 30.05 N	143 ° 9.90 E	2256	PICK UP BOAT(1)
CTD-2	6 23	3 17 +09S	16 ° 29.99 N	143 ° 11.00 E	947	CTD START
CTD-2	6 23	3 36 +09S	16 ° 29.98 N	143 ° 11.03 E	1110	CTD DEEPEST
CTD-2	6 23	3 56 +09S	16 ° 29.99 N	143 ° 11.03 E	1114	CTD FINISHED
CTD-3	6 23	4 30 +09S	16 ° 28.49 N	143 ° 9.02 E	1154	CTD START
CTD-3	6 23	4 50 +09S	16 ° 28.49 N	143 ° 8.94 E	1118	CTD DEEPEST
CTD-3	6 23	5 10 +09S	16 ° 28.49 N	143 ° 8.63 E	1494	CTD FINISHED
JA-21	6 23	7 56 +09S	16 ° 29.99 N	143 ° 9.54 E	304	DROP'D BOAT (NO.1)
JA-21	6 23	8 3 +09S	16 ° 30.03 N	143 ° 9.52 E	141	LAUNCH OF JAGO
JA-21	6 23	8 8 +09S	16 ° 30.03 N	143 ° 9.56 E	188	UNDERWATER OF JAGO
JA-21	6 23	8 27 +09S	16 ° 30.03 N	143 ° 9.60 E	188	PICK'D UP BOAT (NO.1)
JA-21	6 23	11 23 +09S	16 ° 29.50 N	143 ° 9.03 E	188	DROP BOAT(1)
JA-21	6 23	11 27 +09S	16 ° 29.54 N	143 ° 9.01 E	188	POPPING UP OF JAGO
JA-21	6 23	11 41 +09S	16 ° 29.62 N	143 ° 9.10 E	188	RETRIEVE OF JAGO
JA-21	6 23	11 46 +09S	16 ° 29.61 N	143 ° 9.10 E	188	PICK UP BOAT(1)
	6 23	11 53 +09S	16 ° 29.56 N	143 ° 9.00 E	188	START SURVEY
	6 23	13 27 +09S	16 ° 29.87 N	143 ° 10.21 E	870	FINISH SURVEY
ST-57	6 23	13 51 +09S	16 ° 28.07 N	143 ° 10.64 E	1585	IKPT START
ST-57	6 23	14 11 +09S	16 ° 28.33 N	143 ° 10.13 E	1338	ORI SIDE NET START
ST-57	6 23	14 25 +09S	16 ° 28.51 N	143 ° 9.75 E	1247	IKPT DEEPEST
ST-57	6 23	14 41 +09S	16 ° 28.73 N	143 ° 9.38 E	1051	ORI SIDE NET FINISH
ST-57	6 23	15 32 +09S	16 ° 29.46 N	143 ° 8.23 E	1140	IKPT FINISH
ST-58	6 23	15 48 +09S	16 ° 30.10 N	143 ° 7.57 E	1087	IKPT START
ST-58	6 23	15 50 +09S	16 ° 30.17 N	143 ° 7.69 E	1007	ORI SIDE NET START
ST-58	6 23	16 26 +09S	16 ° 31.00 N	143 ° 8.92 E	2048	IKPT DEEPEST
ST-58	6 23	16 30 +09S	16 ° 31.10 N	143 ° 9.07 E	1855	ORI SIDE NET FINISH
ST-58	6 23	17 51 +09S	16 ° 33.13 N	143 ° 11.70 E	1662	IKPT FINISH
JA-22	6 23	23 1 +09S	15 ° 37.97 N	142 ° 46.03 E	60	DROP BOAT (1)
JA-22	6 23	23 6 +09S	15 ° 37.98 N	142 ° 46.05 E	71	LAUNCH OF JAGO
JA-22	6 23	23 11 +09S	15 ° 37.97 N	142 ° 46.04 E	65	UNDERWATER OF JAGO
JA-22	6 23	23 28 +09S	15 ° 37.94 N	142 ° 46.05 E	77	PICK UP BOAT(1)
JA-22	6 23	23 40 +09S	15 ° 37.90 N	142 ° 46.14 E	77	DROP BOAT(2)
JA-22	6 24	1 25 +09S	15 ° 37.68 N	142 ° 46.38 E	77	DROP BOAT(1)
JA-22	6 24	1 29 +09S	15 ° 37.66 N	142 ° 46.38 E	77	POPPING UP OF JAGO
JA-22	6 24	1 51 +09S	15 ° 38.02 N	142 ° 46.16 E	77	RETRIEVE OF JAGO
JA-22	6 24	1 56 +09S	15 ° 38.03 N	142 ° 46.09 E	77	PICK UP BOAT(1)
JA-22	6 24	2 0 +09S	15 ° 38.01 N	142 ° 45.98 E	77	PICK UP BOAT(2)

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
	6 24	2 2 +09S	15 ° 38.02 N	142 ° 45.95 E	77	START SURVEY
	6 24	5 1 +09S	15 ° 37.69 N	142 ° 46.20 E	1912	DROP'D BOAT(2)
	6 24	5 46 +09S	15 ° 37.64 N	142 ° 46.18 E	400	PICK'D UP BOAT(2)
	6 24	6 8 +09S	15 ° 37.61 N	142 ° 46.17 E	375	DROP'D BOAT(2)
	6 24	6 52 +09S	15 ° 37.54 N	142 ° 46.14 E	394	PICK'D UP BOAT(2)
	6 24	7 6 +09S	15 ° 37.34 N	142 ° 46.13 E	387	COM'CED ECHO SOUNDES(1)
	6 24	7 19 +09S	15 ° 37.37 N	142 ° 45.26 E	442	FINISH'D
	6 24	7 28 +09S	15 ° 37.20 N	142 ° 45.34 E	434	COM'CED (2)
	6 24	7 45 +09S	15 ° 37.26 N	142 ° 46.22 E	442	FINISH'D
	6 24	7 50 +09S	15 ° 37.14 N	142 ° 46.13 E	399	COM'CED (3)
	6 24	7 59 +09S	15 ° 37.15 N	142 ° 45.34 E	398	FINISH'D
	6 24	8 10 +09S	15 ° 37.19 N	142 ° 45.40 E	426	COM'CED (4)
	6 24	8 21 +09S	15 ° 37.20 N	142 ° 46.12 E	432	FINISH'D
	6 24	8 30 +09S	15 ° 37.32 N	142 ° 46.16 E	420	COM'CED(5)
	6 24	8 41 +09S	15 ° 37.29 N	142 ° 45.30 E	419	FINISH'D IT
JA-23	6 24	8 57 +09S	15 ° 37.50 N	142 ° 45.41 E	374	DROP'D BOAT (NO.1)
JA-23	6 24	9 5 +09S	15 ° 37.49 N	142 ° 45.43 E	538	LAUNCH OF JAGO
JA-23	6 24	9 10 +09S	15 ° 37.51 N	142 ° 45.39 E	247	UNDERWATER OF JAGO
JA-23	6 24	9 17 +09S	15 ° 37.51 N	142 ° 45.33 E	403	PICK'D UP BOAT (NO.1)
JA-23	6 24	11 46 +09S	15 ° 37.55 N	142 ° 45.27 E	403	POPPING UP OF JAGO
JA-23	6 24	11 49 +09S	15 ° 37.52 N	142 ° 45.27 E	403	DROP BOAT(1)
JA-23	6 24	12 13 +09S	15 ° 37.87 N	142 ° 45.29 E	403	RETRIEVE OF JAGO
JA-23	6 24	12 17 +09S	15 ° 37.86 N	142 ° 45.25 E	403	PICK UP BOAT(1)
ST-59	6 24	12 43 +09S	15 ° 37.63 N	142 ° 43.83 E	3536	IKPT START
ST-59	6 24	13 15 +09S	15 ° 38.19 N	142 ° 44.53 E	1125	ORI SIDE NET START
ST-59	6 24	13 19 +09S	15 ° 38.28 N	142 ° 44.60 E	1101	IKPT DEEPEST
ST-59	6 24	13 56 +09S	15 ° 39.11 N	142 ° 45.36 E	1301	ORI SIDE NET FINISH
ST-59	6 24	14 29 +09S	15 ° 39.81 N	142 ° 46.04 E	1917	IKPT FINISH
ST-60	6 24	14 46 +09S	15 ° 38.99 N	142 ° 47.00 E	1933	IKPT START
ST-60	6 24	15 14 +09S	15 ° 38.02 N	142 ° 46.83 E	2028	ORI SIDE NET START
ST-60	6 24	15 29 +09S	15 ° 37.49 N	142 ° 46.83 E	1832	IKPT DEEPEST
ST-60	6 24	15 55 +09S	15 ° 36.52 N	142 ° 46.82 E	1935	ORI SIDE NET FINISH
ST-60	6 24	16 42 +09S	15 ° 34.81 N	142 ° 46.69 E	3584	IKPT FINISH
ST-61	6 24	17 2 +09S	15 ° 35.90 N	142 ° 46.84 E	4796	IKPT START
ST-61	6 24	17 29 +09S	15 ° 36.41 N	142 ° 45.66 E	4967	ORI SIDE NET START
ST-61	6 24	17 42 +09S	15 ° 36.66 N	142 ° 45.10 E	5025	IKPT DEEPEST
ST-61	6 24	18 10 +09S	15 ° 37.10 N	142 ° 44.04 E	5787	ORI SIDE NET FINISH
ST-61	6 24	18 27 +09S	15 ° 37.44 N	142 ° 43.36 E	5981	IKPT FINISH
	6 25	0 2 +09S	16 ° 29.40 N	143 ° 8.92 E	492	DROP BOAT(2)
	6 25	1 14 +09S	16 ° 29.72 N	143 ° 8.69 E	465	PICK UP BOAT(2)
	6 25	1 28 +09S	16 ° 29.89 N	143 ° 8.70 E	527	DROP BOAT(2)
	6 25	1 56 +09S	16 ° 29.98 N	143 ° 8.61 E	321	PICK UP BOAT(1)
ST-62	6 25	2 58 +09S	16 ° 29.37 N	143 ° 10.14 E	479	IKPT START
ST-62	6 25	3 1 +09S	16 ° 29.43 N	143 ° 10.14 E	434	ORI SIDE NET START
ST-62	6 25	3 30 +09S	16 ° 29.95 N	143 ° 10.24 E	827	IKPT DEEPEST
ST-62	6 25	3 40 +09S	16 ° 30.12 N	143 ° 10.28 E	377	ORI SIDE NET FINISH
ST-62	6 25	4 16 +09S	16 ° 30.97 N	143 ° 10.40 E	1031	IKPT FINISH
ST-62	6 25	4 27 +09S	16 ° 30.99 N	143 ° 10.10 E	1368	IKPT START
ST-62	6 25	4 31 +09S	16 ° 30.97 N	143 ° 9.96 E	1030	ORI SIDE NET START
ST-63	6 25	5 8 +09S	16 ° 30.76 N	143 ° 8.84 E	1153	IKPT DEEPEST

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-63	6 25	5 11 +09S	16 ° 30.74 N	143 ° 8.73 E	1010	ORI SIDE NET FINISH
ST-63	6 25	5 52 +09S	16 ° 30.57 N	143 ° 7.19 E	2007	IKPT FINISH
ST-64	6 25	7 1 +09S	16 ° 31.28 N	143 ° 8.07 E	1294	IKPT START
ST-64	6 25	7 13 +09S	16 ° 30.87 N	143 ° 7.87 E	1100	ORI SIDE NET START
ST-64	6 25	7 25 +09S	16 ° 30.42 N	143 ° 7.77 E	979	IKPT DEEPEST
ST-64	6 25	7 34 +09S	16 ° 30.13 N	143 ° 7.71 E	984	ORI SIDE NET FINISH
ST-64	6 25	8 16 +09S	16 ° 28.56 N	143 ° 7.63 E	1471	IKPT FINISH
ST-65	6 25	8 37 +09S	16 ° 28.91 N	143 ° 7.97 E	1561	IKPT START
ST-65	6 25	8 51 +09S	16 ° 28.93 N	143 ° 8.46 E	2032	ORI SIDE NET START
ST-65	6 25	9 2 +09S	16 ° 28.94 N	143 ° 8.85 E	813	IKMT NET DEEPEST
ST-65	6 25	9 10 +09S	16 ° 28.90 N	143 ° 9.16 E	1108	ORI SIDE NET FINISH
ST-65	6 25	9 57 +09S	16 ° 28.79 N	143 ° 10.93 E	1348	IKPT FINISH
	6 25	10 23 +09S	16 ° 30.04 N	143 ° 9.57 E	1868	COM'CE ACOSUTIC SURVEY
	6 25	10 40 +09S	16 ° 29.77 N	143 ° 8.71 E	2007	FINISH IT
	6 25	11 10 +09S	16 ° 29.70 N	143 ° 9.47 E	1892	FINISH SURVEY
JA-24	6 25	11 31 +09S	16 ° 29.66 N	143 ° 9.16 E	2271	DROP BOAT(1)
JA-24	6 25	11 39 +09S	16 ° 29.67 N	143 ° 9.16 E	445	LAUNCH OF JAGO
JA-24	6 25	11 45 +09S	16 ° 29.65 N	143 ° 9.20 E	378	UNDERWATER OF JAGO
JA-24	6 25	11 50 +09S	16 ° 29.62 N	143 ° 9.17 E	408	PICK UP BOAT(1)
JA-24	6 25	13 16 +09S	16 ° 29.59 N	143 ° 9.11 E	408	DROP BOAT(1)
JA-24	6 25	13 28 +09S	16 ° 29.58 N	143 ° 9.12 E	408	POPPING UP OF JAGO
JA-24	6 25	13 43 +09S	16 ° 29.55 N	143 ° 9.34 E	408	RETRIEVE OF JAGO
JA-24	6 25	13 48 +09S	16 ° 29.55 N	143 ° 9.33 E	408	PICK UP BOAT(1)
ST-66	6 25	14 7 +09S	16 ° 28.96 N	143 ° 10.58 E	738	IKPT START
ST-66	6 25	14 24 +09S	16 ° 29.54 N	143 ° 10.79 E	1168	ORI SIDE NET START
ST-66	6 25	14 39 +09S	16 ° 30.01 N	143 ° 10.99 E	1098	IKPT DEEPEST
ST-66	6 25	14 45 +09S	16 ° 30.21 N	143 ° 11.06 E	1086	ORI SIDE NET FINISH
ST-66	6 25	15 46 +09S	16 ° 32.48 N	143 ° 11.90 E	3133	IKPT FINISH
ST-67	6 25	16 14 +09S	16 ° 31.48 N	143 ° 10.07 E	3252	IKPT START
ST-67	6 25	16 30 +09S	16 ° 31.47 N	143 ° 9.73 E	3738	ORI SIDE NET START
ST-67	6 25	16 50 +09S	16 ° 31.46 N	143 ° 9.30 E	4028	ORI SIDE NET FINISH
ST-67	6 25	17 35 +09S	16 ° 31.44 N	143 ° 8.33 E	3295	IKPT FINISH
ST-68	6 25	17 51 +09S	16 ° 31.00 N	143 ° 7.54 E	3450	IKPT START
ST-68	6 25	18 10 +09S	16 ° 30.43 N	143 ° 7.44 E	3130	ORI SIDE NET START
ST-68	6 25	18 30 +09S	16 ° 29.75 N	143 ° 7.41 E	3234	ORI SIDE NET FINISH
ST-68	6 25	19 3 +09S	16 ° 28.63 N	143 ° 7.31 E	3622	IKPT FINISH
CTD	6 26	1 27 +09S	15 ° 37.59 N	142 ° 43.84 E	1343	CTD START
CTD	6 26	1 52 +09S	15 ° 37.68 N	142 ° 43.65 E	1692	CTD DEEPEST
CTD	6 26	2 11 +09S	15 ° 37.73 N	142 ° 43.55 E	1749	CTD FINISHED
	6 26	2 42 +09S	15 ° 38.97 N	142 ° 44.66 E	1497	START ADCP SURVEY
	6 26	4 6 +09S	15 ° 39.00 N	142 ° 44.53 E	2949	ADCP SURVEY FINISH
	6 26	4 57 +09S	15 ° 37.71 N	142 ° 46.18 E	1846	DROP BOAT(2)
	6 26	5 2 +09S	15 ° 37.68 N	142 ° 46.17 E	2192	DROP BOAT(2)
	6 26	5 55 +09S	15 ° 37.67 N	142 ° 46.27 E	889	PICK UP BOAT(2)
	6 26	6 0 +09S	15 ° 37.67 N	142 ° 46.15 E	857	DROP BOAT(2)
	6 26	7 3 +09S	15 ° 38.04 N	142 ° 45.80 E	285	PICK UP BOAT(2)
	6 26	7 12 +09S	15 ° 38.06 N	142 ° 45.81 E	243	COM'CE ACOUSTIC SURVEY
	6 26	10 31 +09S	15 ° 37.51 N	142 ° 45.33 E	221	FINISH ACOUSTIC SURVEY
JA-25	6 26	10 54 +09S	15 ° 38.03 N	142 ° 46.01 E	160	DROP BOAT (NO.1)
JA-25	6 26	11 5 +09S	15 ° 38.02 N	142 ° 46.00 E	468	LAUNCH OF JAGO

Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
JA-25	6 26	11 13 +09S	15 ° 38.12 N	142 ° 46.05 E	194	UNDERWATER OF JAGO
JA-25	6 26	11 21 +09S	15 ° 38.10 N	142 ° 45.96 E	215	PICK UP BOAT(1)
JA-25	6 26	13 27 +09S	15 ° 38.06 N	142 ° 46.26 E	215	DROP BOAT(1)
JA-25	6 26	13 31 +09S	15 ° 38.01 N	142 ° 46.25 E	215	POPPING UP OF JAGO
JA-25	6 26	13 49 +09S	15 ° 37.99 N	142 ° 46.15 E	215	RETRIEVE OF JAGO
JA-25	6 26	13 56 +09S	15 ° 37.97 N	142 ° 46.30 E	215	PICK UP BOAT(1 ()
ST-69	6 26	15 3 +09S	15 ° 38.60 N	142 ° 44.81 E	524	IKPT START
ST-69	6 26	15 25 +09S	15 ° 37.82 N	142 ° 44.40 E	385	ORI SIDE NET START
ST-69	6 26	15 55 +09S	15 ° 36.69 N	142 ° 43.94 E	576	ORI SIDE NET FINISH
ST-69	6 26	16 2 +09S	15 ° 36.39 N	142 ° 43.84 E	728	IKPT DEEPEST
ST-69	6 26	16 39 +09S	15 ° 34.99 N	142 ° 43.11 E	366	IKPT FINISH
ST-70	6 26	17 9 +09S	15 ° 36.46 N	142 ° 44.68 E	727	IKPT START
ST-70	6 26	17 29 +09S	15 ° 36.36 N	142 ° 45.20 E	449	ORI SIDE NET START
ST-70	6 26	17 35 +09S	15 ° 36.36 N	142 ° 45.29 E	682	IKPT DEEPEST
ST-70	6 26	18 0 +09S	15 ° 36.19 N	142 ° 45.86 E	644	ORI SIDE NET FINISH
ST-70	6 26	18 17 +09S	15 ° 36.09 N	142 ° 46.25 E	515	IKPT FINISH
ST-71	6 26	18 49 +09S	15 ° 38.49 N	142 ° 44.72 E	561	IKPT START
ST-71	6 26	19 10 +09S	15 ° 38.63 N	142 ° 45.21 E	633	ORI SIDE NET START
ST-71	6 26	19 12 +09S	15 ° 38.61 N	142 ° 45.30 E	660	IKPT DEEPEST
ST-71	6 26	19 40 +09S	15 ° 38.73 N	142 ° 45.78 E	664	ORI SIDE NET FINISH
ST-71	6 26	20 3 +09S	15 ° 38.78 N	142 ° 46.24 E	486	IKPT FINISH
PHOTO	6 26	23 40 +09S	16 ° 22.09 N	143 ° 5.74 E	2350	DROP BOAT(1)
PHOTO	6 26	23 44 +09S	16 ° 22.08 N	143 ° 5.70 E	2352	DROP BOAT(2)
PHOTO	6 26	23 48 +09S	16 ° 21.98 N	143 ° 5.73 E	2356	LAUNCH OF JAGO
PHOTO	6 27	0 24 +09S	16 ° 21.87 N	143 ° 5.76 E	2373	RETRIEVE OF JAGO
PHOTO	6 27	0 30 +09S	16 ° 21.82 N	143 ° 5.71 E	2385	PICK UP BOAT(1)
PHOTO	6 27	0 39 +09S	16 ° 21.78 N	143 ° 5.62 E	2386	PICK UP BOAT(2)
ST-72	6 27	4 0 +09S	16 ° 28.72 N	143 ° 10.04 E	1216	IKPT START
ST-72	6 27	4 25 +09S	16 ° 29.53 N	143 ° 10.14 E	1277	ORI SIDE NET START
ST-72	6 27	4 30 +09S	16 ° 29.67 N	143 ° 10.13 E	1287	IKPT DEEPEST
ST-72	6 27	4 56 +09S	16 ° 30.35 N	143 ° 10.29 E	787	ORI SIDE NET FINISH
ST-72	6 27	5 17 +09S	16 ° 30.95 N	143 ° 10.34 E	1474	IKPT FINISH
ST-73	6 27	5 28 +09S	16 ° 30.97 N	143 ° 10.03 E	805	IKPT START
ST-73	6 27	5 50 +09S	16 ° 30.96 N	143 ° 9.40 E	774	ORI SIDE NET START
ST-73	6 27	5 56 +09S	16 ° 30.96 N	143 ° 9.24 E	754	IKPT DEEPEST
ST-73	6 27	6 20 +09S	16 ° 30.89 N	143 ° 8.61 E	1324	ORI SIDE NET FINISH
ST-73	6 27	7 1 +09S	16 ° 30.72 N	143 ° 7.36 E	1436	IKPT FINISH
	6 27	7 16 +09S	16 ° 31.00 N	143 ° 8.04 E	1990	COM'CE ADCP
	6 27	8 19 +09S	16 ° 31.01 N	143 ° 7.98 E	1151	FINISH ADCP
	6 27	8 32 +09S	16 ° 30.51 N	143 ° 8.87 E	1029	SURVEY START
	6 27	8 57 +09S	16 ° 29.66 N	143 ° 8.67 E	249	CHECK THE POSITION
	6 27	9 0 +09S	16 ° 29.87 N	143 ° 8.57 E	378	SURVEY FINISH
JA-26	6 27	9 4 +09S	16 ° 29.96 N	143 ° 8.53 E	1232	DROP BOAT (NO.1)
JA-26	6 27	9 15 +09S	16 ° 29.95 N	143 ° 8.55 E	893	LAUNCH OF JAGO
JA-26	6 27	9 16 +09S	16 ° 29.95 N	143 ° 8.56 E	893	UNDERWATER OF JAGO
JA-26	6 27	9 23 +09S	16 ° 29.98 N	143 ° 8.65 E	893	PICK UP BOAT (NO.1)
JA-26	6 27	10 19 +09S	16 ° 29.69 N	143 ° 8.49 E	893	POPPING UP OF JAGO
JA-26	6 27	10 21 +09S	16 ° 29.68 N	143 ° 8.50 E	893	DROP BOAT (NO.1)
JA-26	6 27	10 41 +09S	16 ° 29.58 N	143 ° 8.89 E	893	RETRIEVE OF JAGO
JA-26	6 27	10 46 +09S	16 ° 29.54 N	143 ° 8.94 E	893	PICK UP BOAT (NO.1)

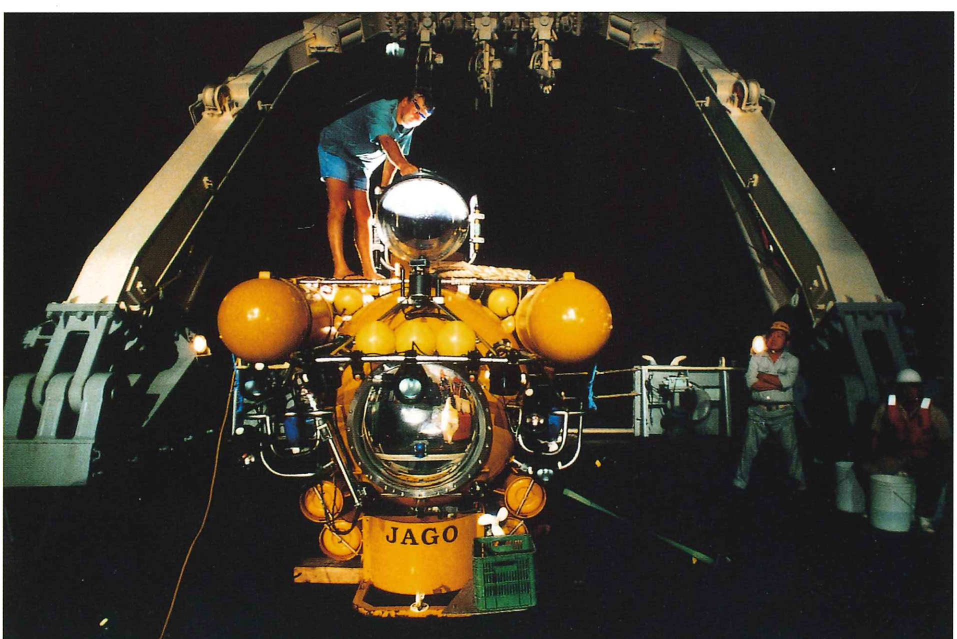
Time is indicated in GMT

Station and Working log

St.	Date	Time	Latitude	Longitude	Depth	Event
ST-74	6 27	11 18 +09S	16 ° 30.99 N	143 ° 7.77 E	893	IKPT START
ST-74	6 27	11 30 +09S	16 ° 30.92 N	143 ° 8.26 E	893	ORI SIDE NET START
ST-74	6 27	11 44 +09S	16 ° 30.89 N	143 ° 8.88 E	970	IKPT DEEPEST
ST-74	6 27	11 50 +09S	16 ° 30.85 N	143 ° 9.13 E	972	ORI SIDE NET FINISH
ST-74	6 27	12 23 +09S	16 ° 30.65 N	143 ° 10.75 E	1021	IKPT FINISH
ST-75	6 27	12 42 +09S	16 ° 30.83 N	143 ° 10.00 E	1052	IKPT START
ST-75	6 27	12 50 +09S	16 ° 30.51 N	143 ° 10.04 E	928	ORI SIDE NET START
ST-75	6 27	13 9 +09S	16 ° 29.69 N	143 ° 10.21 E	895	IKPT DEEPEST
ST-75	6 27	13 10 +09S	16 ° 29.67 N	143 ° 10.20 E	903	ORI SIDE NET FINISH
ST-75	6 27	13 53 +09S	16 ° 28.10 N	143 ° 10.39 E	1470	IKPT FINISH
ST-76	6 27	13 59 +09S	16 ° 28.02 N	143 ° 10.32 E	1470	IKPT START
ST-76	6 27	14 10 +09S	16 ° 28.19 N	143 ° 10.05 E	1370	ORI SIDE NET START
ST-76	6 27	14 23 +09S	16 ° 28.27 N	143 ° 9.74 E	1305	IKPT DEEPEST
ST-76	6 27	14 30 +09S	16 ° 28.34 N	143 ° 9.58 E	1248	ORI SIDE NET FINISH
ST-76	6 27	14 58 +09S	16 ° 28.44 N	143 ° 8.95 E	1154	IKPT FINISH
	6 28	7 2 +09S	20 ° 29.77 N	142 ° 26.36 E	231	START SURVEY
	6 28	8 3 +09S	20 ° 29.65 N	142 ° 26.35 E	406	SURVEY FINISH
	6 28	8 21 +09S	20 ° 30.88 N	142 ° 26.25 E	394	ADCP START
	6 28	9 36 +09S	20 ° 30.74 N	142 ° 26.79 E	1611	CHECK THE POSITION
	6 28	9 36 +09S	20 ° 30.74 N	142 ° 26.88 E	1621	FINISH ADCP
JA-27	6 28	10 9 +09S	20 ° 29.40 N	142 ° 26.84 E	1075	DROP BOAT (NO.1)
JA-27	6 28	10 20 +09S	20 ° 29.36 N	142 ° 26.78 E	131	LAUNCH OF JAGO
JA-27	6 28	10 25 +09S	20 ° 29.44 N	142 ° 26.79 E	144	UNDERWATER OF JAGO
JA-27	6 28	10 52 +09S	20 ° 29.42 N	142 ° 26.91 E	144	PICK UP BOAT (NO.1)
JA-27	6 28	14 29 +09S	20 ° 29.02 N	142 ° 26.40 E	144	DROP BOAT(1)
JA-27	6 28	14 41 +09S	20 ° 28.97 N	142 ° 26.43 E	144	POPPING UP OF JAGO
JA-27	6 28	14 54 +09S	20 ° 28.97 N	142 ° 26.54 E	428	RETRIEVE OF JAGO
JA-27	6 28	14 59 +09S	20 ° 28.99 N	142 ° 26.56 E	451	PICK UP BOAT(1)
ST-77	6 29	4 5 +09S	23 ° 52.29 N	142 ° 0.91 E	2822	ORI NET START
ST-77	6 29	4 48 +09S	23 ° 54.23 N	142 ° 0.45 E	2829	ORI NET DEEPEST
ST-77	6 29	6 6 +09S	23 ° 57.38 N	142 ° 0.24 E	2839	ORI NET FINISH
	6 29	6 14 +09S	23 ° 57.57 N	142 ° 0.24 E	2836	START CALIBRATION
	6 29	6 53 +09S	23 ° 57.60 N	142 ° 0.31 E	2840	FINISH IT
A-6	6 29	18 31 +09S	27 ° 0.16 N	141 ° 37.62 E	3916	RELEACE ARGOS BUOY(250M)
A-6	6 29	18 34 +09S	27 ° 0.31 N	141 ° 37.62 E	3918	RELEASE ARGOS BUOY(80M)

Time is indicated in GMT

Tracking of the artificially matured eel at sea mount



Submersible JAGO preparing for the next dive.

Participants in Leg 1.

Participants in Leg 2