

Preliminary Report  
of  
The Hakuhō Maru Cruise KH-73-2

February 20 - March 27, 1973  
Western North Pacific Waters, Adjacent  
to Ryukyu and Taiwan Islands

Ocean Research Institute  
University of Tokyo  
1974

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By  
The Scientific Members of the Expedition

Edited by  
Masaharu NISHIWAKI

1974



## PREFACE

This is a preliminary report of work done during KH-73-2 cruise of the R/V Hakuho-maru of the University of Tokyo from February 20 through to March 27, 1973.

The main purpose of this cruise was to collect leptocephalus of the Japanese eel (*Anguilla japonica*). The plan was adopted after the discussion in 1970 by scientists in various fields such as physical and chemical oceanography, marine geology and marine and fisheries biology. The original plan was reexamined in greater detail in 1972.

Previous records of collection of leptocephalus of the Japanese eel in the Pacific Ocean are as follows :

Date	Position collected	Individuals
Feb. 12, 1956	128°57.0'E. 24°32.0'N.	19
Nov. 8, 1967	121°08.5'E. 21°40.5'N.	1

Considering these positions the first survey in 1973 was carried out in the Western North Pacific in waters adjacent to Taiwan and the Ryukyu Islands. The second one is to be done on the cruise KH-73-5 in November and December 1973 in the same area. It is recommended that the reader refer also to the report of the latter work which will be published in the near future.

Along with the main work of collecting leptocephalus, studies of other scientific fields were also carried out during the cruise. Although preliminary records of all works are presented in this report, it is expected that the works will be compiled and discussed in detail later and presented to the scientific societies.

It was the time of prevailing strong north-west winds but fortunately enough, there were many fine days and all work was carried out as had been planned. There was no mishap or accident to members on board nor to machinery throughout the cruise, and here I thank the crew and scientists on board for their thoughtful and patient care.

Masaharu Nishiwaki  
Chief Scientist





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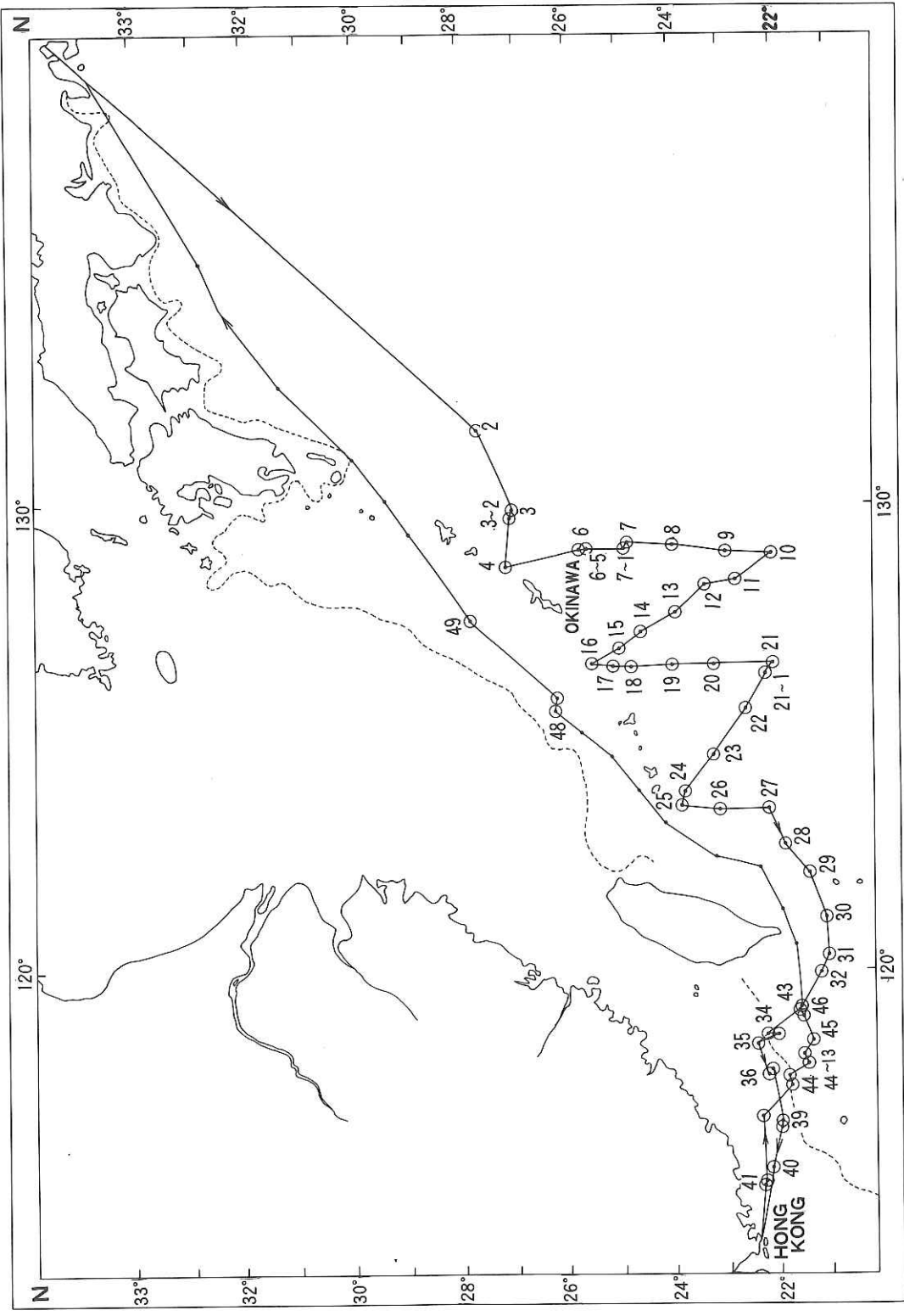


Fig.0-1. Track chart and sampling positions of KH-73-2 cruise.

## OUTLINE OF THE CRUISE

The aim of this cruise was mainly concerned with collecting large numbers of Anguilla larvae especially those of Japanese eel Anguilla japonica which is possibly distributed in the surveyed area according to the studies published to date. The stations in which sampling was done by various plankton nets is shown in Table 0-1.

The main sampling gear for plankton is a large 4 meter hexagon-net; a 10 feet IKMT, a 1.6 meter ORI-net, and a 1.3 meter larvae net was also used as indicated in the appendix. All the sampling data is given also in Table 2-1.

The many biologists on board cooperated on net sampling. Several working groups were formed to engage in the watch and preliminary sorting of the samples just after the net operation. Basic sorting is done to separate samples into leptocephalus larvae of Anguillidae, other fish larvae, and general zooplankton. The leptocephalus belonging to Anguillidae was examined at once to determine if it was leptocephalus of Japanese eel Anguilla japonica or not.

In this cruise one elver of Japanese eel was found in the station 39-1 and a successive expanded survey was carried out around the station but no other larva of the Japanese eel was taken. One leptocephalus belonging to Anguilla bicolor pacifica was caught in the station 30-8. Examinations of fish larvae and zooplankton are now in progress, the preliminary abstracts of which are given in this report.

A study on the biology of benthos, a population study of fish by echo sounder, the calibration of STD instruments, and physical studies of bottom boundary layers were also carried out by scientists on board and are also included in this report.

TABLE 0-1 CRUISE ITINERARY

	Arrival	Departure
Tokyo		20 February 1973
Sta. 2	22 February	-----
Hong Kong	12 March	17 March
Sta. 49	-----	23 March
Tokyo	26 March	

## Scientists aboard

Nishiwaki, Masaharu	Ocean Res. Inst., Univ. of Tokyo	Biology
Yamamoto, Gotaro	" "	"
Horikoshi, Masuoki	" "	"
Nemoto, Takahisa	" "	"
Ishii, Takeo	" "	"
Kawaguchi, Kouichi	" "	"
Sakamoto, Wataru	" "	"
Mukai, Hiroshi	" "	"
Oguchi, Setsuko	" "	Physical Oceanography
Aioi, Keiko	" "	Biology
Watanabe, Masaaki	" "	Physical Oceanography
Hasumoto, Hiroshi	" "	Biology
Matsumiya, Yoshiharu	" "	"
Tsukamoto, Katsumi	" "	"
Abe, Hitoshi	" "	"
Matsushita, Katsumi	" "	"
Kubota, Tadashi	Marine Sciences and Technology, Tokai Univ.	"
Uotani, Itsuro	" "	"
Sato, Fumiaki	" "	"
Ohara, Sannosuke	" "	"
Takai, Tohru	College of Fisheries, Shimonoseki	"
Tabeta, Osamu	" "	"
Matsui, Seiichi	Faculty of Agriculture, Kyushu Univ.	"
Honda, Teruo	" "	"
Mizue, Kazuhiro	Faculty of Fisheries, Nagasaki Univ.	"
Ahmad, Muchtar	" "	"
Ozawa, Takakazu	Faculty of Fisheries, Kagoshima Univ.	"

1. FOOD AND FEEDING OF THE THREE DEEP SEA Thysanopoda SPECIES  
( Euphausiid Crustacea )

T. NEMOTO

Thysanopoda cornuta, T. egregia and T. spinicaudata are considered to be bathypelagic species and their food and feeding have scarcely been examined up to now. Their feeding structures and stomach contents (volume and species) were studied to determine their possible significance in the food chain of the bathypelagic ecosystem.

The examined species were 28 T. cornuta, 12 T. egregia and 6 T. spinicaudata. 32 T. tricuspidata, 6 T. acutifrons and 4 T. cristata were compared to these deep-sea euphausiids. Among 31 deep-sea euphausiids, 23 specimens contained food. The most dominant food was copepods and chaetognaths, euphausiids and mysids followed in amount. The ommatidia and spermatophores of crustacea were also found in stomachs. The eye ball and vertebrae of fish were found in 4 specimens of T. egregia and one of T. cornuta showing that T. egregia is a most voracious animal. One T. egregia contained 45 vertebrae indicating that at the least 2 specimens of Cyclothone or allied species of micronektonic fish were fed upon by that euphausiid. Another T. egregia had taken one small pelagic cephalopod too. Brown oil globules were often found in the stomachs and it is believed that stomachs play a storage function to some extent in these species. The weight of stomach contents according to feeding condition has log-linear relationship to the weight of the body of euphausiids.

The body length of fish and chaetognaths are determined by the allomorphic relationship between the length of the vertebrae of fish and the jaws of chaetognaths to their body lengths. However, there is no clear relationship between the size of predator euphausiids and their prey.

The filtering setae of deep-sea euphausiids and barbs are scarcely developed in these three species, but surface feeding T. tricuspidata has well developed setae and barbs in the carpus of the leg. The allomorphosis among segments of legs shows that T. tricuspidata has a more developed carpus segment than these deep-sea euphausiids. The stomachs of the deep-sea euphausiids have folds in the wall which fold flat when the stomachs are vacant but expand when they are feeding. The spine and setae of the inner wall of the stomachs are similar to those of carnivorous euphausiids and lack the cluster spines of filter feeding euphausiids such as Euphausia superba. Pars molaris of the mandibles is not developed but pars incisiva is well developed.

Considering the giant body size of these three euphausiids and possible longevity of life, these deep-sea Thysanopoda species are considered to be of higher rank and must be a significant part of the food chain as a carnivore in the deep-sea ecosystem.

2. THE TAXONOMIC AND DISTRIBUTIONAL STUDY ON THE DEEP-SEA FISHES BELONGING TO THE FAMILIES OF GONOSTOMATIDAE, STERNOPTYCHIDAE, MELANOSTOMIATIDAE, MELAMPHIDAE AND CHAULIODONTIDAE.

K. KAWAGUCHI

During the course of study on the spawning grounds of the Japanese eel (Anguilla japonica) and other apodes leptocephalus, some deep-sea fishes belonging to the families of Gonostomatidae, Sternoptychidae, Melanostomiatidae, Melamphidae and Chauliodontidae were expected to be collected also. Considering the very restricted knowledge of the taxonomy and distribution ecology of these deep-sea fishes, the author intends to determine which species of the above-mentioned families occur in the surveyed area and further to learn some features of their geographical distribution and diurnal vertical migration. Sorting of the samples collected on this cruise was completed to generic or family levels as shown in Table 2-1. Species identification and distributional study will be finished in the near future.



Table 2-1. Total catch of the fishes belonging to Gonostomatidae, Sternoptychidae and Chauliodontidae

	2-1	2-2	2-3	3-1	3-2	3-3	3-4	4-1	4-2	4-3	5-1	5-2	5-3	6-1	6-2	6-3	6-4	6-5	6-6	6-7	7-1	7-2	7-3	7-4	8-1	8-2	8-3		
<b>Gonostomatidae</b>																													
Diplophos sp.	0	0	0	0	2	1	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	8	0	0	0	
Vinciguerria spp.	166	25	18	0	39	88	19	65	74	7	10	1	0	3	12	4	0	140	14	0	1	3	0	156	34	3	1		
Cyclothone spp.	0	40	31	41	10	14	18	7	30	0	8	0	0	107	0	0	0	0	2	0	0	2	0	32	14	7	0		
Gonostoma spp.	4	0	0	3	5	0	0	9	22	7	107	0	0	15	6	0	0	10	22	10	1	10	12	20	52	7	0		
Polllichthys mauii	2	0	0	0	1	0	0	12	9	0	1	0	0	1	1	0	0	11	0	0	0	9	0	4	0	0	0		
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Ichthyococcus sp.	2	0	0	0	0	0	1	2	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0		
Unidentified	0	0	1	0	0	0	4	0	0	8	0	0	0	0	0	0	5	0	0	2	0	0	3	0	0	0	2		
<b>Sternoptychidae</b>																													
Sternoptychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	7	0	
<b>Chauliodontidae</b>																													
Chauliodontidae	38	0	1	1	2	0	0	12	0	13	36	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	0	
<b>Gonostomatidae</b>																													
Gonostomatidae	9-1	9-2	9-3	9-4	10-1	10-2	10-3	10-4	11-1	11-2	11-3	12-1	12-2	12-3	13-1	13-2	13-3	13-4	13-5	14-1	14-2	14-3	15-1	15-2	15-3	15-4	16-1		
Diplophos sp.	0	1	0	0	4	0	1	14	2	0	0	0	0	0	1	0	0	4	0	2	0	0	0	0	0	0	0		
Vinciguerria spp.	5	19	0	0	149	0	0	370	16	0	0	32	0	0	150	0	0	15	17	135	8	2	30	0	0	4	0		
Cyclothone spp.	3	0	0	0	2	0	875	44	0	0	287	0	0	18	0	0	8	242	50	3	1	3	0	0	146	0			
Gonostoma spp.	75	22	0	0	0	0	0	93	8	0	0	31	0	0	1	0	0	0	18	0	0	0	53	0	0	6	15		
Polllichthys mauii	2	1	0	0	1	0	0	0	0	0	4	0	0	13	0	0	6	2	3	0	0	0	0	0	0	0	0		
Valenciennellus sp.	1	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0		
Ichthyococcus sp.	2	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
Unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0		
<b>Sternoptychidae</b>																													
Sternoptychidae	0	2	0	0	0	0	0	34	2	0	0	6	0	0	0	0	0	0	0	2	22	0	0	0	0	0	1	0	
<b>Chauliodontidae</b>																													
Chauliodontidae	1	3	0	0	0	0	0	30	4	0	0	9	0	0	0	0	0	0	0	2	15	0	3	0	0	0	3		
<b>Gonostomatidae</b>																													
Gonostomatidae	16-2	16-3	16-4	16-5	16-6	16-7	16-8	16-9	16-10	16-11	16-12	17-1	17-2	17-3	18-1	18-2	18-3	18-4	18-5	18-6	18-7	18-8	18-9	18-10	19-1	19-2			
Diplophos sp.	0	0	0	0	0	0	0	1	0	0	1	0	0	0	5	0	0	4	7	8	4	12	11	19	0	0			
Vinciguerria spp.	0	0	25	47	94	56	90	46	15	14	28	24	14	0	77	22	44	114	196	118	172	32	50	14	40	11			
Cyclothone spp.	2	1	4	6	9	5	73	24	39	4	6	2	0	0	7	3	6	2	2	4	17	9	8	17	209	0			
Gonostoma spp.	0	0	2	0	0	0	0	16	0	1	0	28	0	0	24	2	1	3	5	2	54	11	64	6	5	20			
Polllichthys mauii	0	0	7	2	2	3	1	6	12	2	3	0	0	0	4	0	0	2	2	3	4	0	2	0	0	0			
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
<b>Sternoptychidae</b>																													
Sternoptychidae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0			
<b>Chauliodontidae</b>																													
Chauliodontidae	0	0	0	1	0	0	0	2	0	0	4	0	0	0	2	0	0	0	2	1	1	8	5	16	0	4			

Table 2-1. Cont.

	20-1	20-2	20-3	20-4	20-5	20-6	20-7	20-8	20-9	20-10	20-11	20-12	20-13	20-14	21-1	21-2	21-3	21-4	21-5	21-6	21-7	21-8	21-9	21-10	21-11		
<b>Gonostomatidae</b>																											
Diplophos sp.	12	1	0	18	13	24	14	8	5	26	12	1	29	2	0	3	0	3	7	0	3	2	0	0	4		
Vinciguerrria spp.	40	0	0	7	131	31	25	1111	114	63	123	4	7	21	0	98	1	4	89	5	6	11	0	5	1		
Cyclothone spp.	4	4	0	5	4	7	18	9	6	11	1	0	7	666	37	48	2	3	13	1	2	0	0	2			
Gonostoma spp.	3	0	0	1	1	0	0	0	0	1	0	0	24	9	0	0	0	1	0	0	0	0	0	0			
Polllichthys mauii	1	0	0	2	2	0	4	3	0	0	6	2	0	0	0	0	0	0	0	0	0	0	0	0			
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0			
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Sternoptychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0			
Chauliodontidae	0	0	0	0	0	0	0	0	1	0	1	0	1	16	2	0	0	0	1	0	0	0	0	0			
<b>Gonostomatidae</b>																											
Diplophos sp.	2	17	7	8	20	4	0	0	3	0	0	3	0	3	2	2	1	1	3	1	16	59	3	0	4		
Vinciguerrria spp.	41	63	27	74	44	47	105	0	0	17	0	1	5	93	66	6	131	82	8	22	44	0	98	2	42		
Cyclothone spp.	1	3	0	7	6	16	563	1	0	26	0	2	9	15	0	1	2	4	3	3	4	0	28	0	14		
Gonostoma spp.	0	0	0	0	0	0	0	18	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	51	0	9	
Polllichthys mauii	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	1	5	0	2	1	0	21	0	1			
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0		
Sternoptychidae	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	
Chauliodontidae	0	0	0	0	0	0	0	9	0	0	0	0	0	0	1	0	1	1	0	1	2	0	12	0	3		
<b>Gonostomatidae</b>																											
Diplophos sp.	8	2	2	31	0	3	4	0	0	7	3	0	0	0	2	0	4	4	5	2	6	4	4	0	8		
Vinciguerrria spp.	156	7	18	78	0	18	19	3	0	6	49	2	1	4	72	155	20	36	68	21	8	2	9	16	2	11	
Cyclothone spp.	11	1	0	3	0	0	1	0	0	0	2	0	0	37	154	17	6	28	7	22	4	1	0	0	10		
Gonostoma spp.	62	21	10	30	0	2	2	0	0	3	16	0	0	1	12	0	0	0	0	0	0	0	0	0	0		
Polllichthys mauii	27	0	0	0	0	2	0	0	0	0	0	0	0	0	0	5	0	0	11	0	1	0	1	0	0		
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Unidentified	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
Sternoptychidae	6	0	0	0	0	0	0	0	0	0	0	0	0	4	22	0	0	0	0	0	0	0	0	0	0		
Chauliodontidae	15	1	0	0	0	0	4	0	0	1	1	0	0	0	10	2	0	0	0	1	0	0	1	1	1	0	

Table 2-1. Cont.

	29-1	29-2	29-3	29-4	30-1	30-2	30-3	30-4	30-5	30-6	30-7	30-8	30-9	30-10	30-11	30-12	31-1	31-2	31-3	31-4	32-1	32-2	34-1	34-2	34-3	34-4		
<b>Gonostomatidae</b>																												
Diplophos sp.	1	0	0	0	11	1	0	3	15	8	2	1	24	0	19	0	3	0	0	0	0	0	0	1	1	3	0	
Vinciguerrria spp.	8	0	0	0	8	0	0	5	20	4	0	2	0	0	0	0	24	8	6	2	7	2	110	11	2	1		
Cyclothone spp.	7	0	1	69	6	4	0	5	20	9	1	4	2	0	0	0	10	30	16	120	142	0	111	9	4	3		
Gonostoma spp.	16	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	67	0	0	1	3	0	5	0	0	0		
Polllichthys mauii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	8	0	0	0	0	0		
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0		
Unidentified	0	0	0	0	4	0	0	0	0	6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Sternoptychidae	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	12	5	0	6	0	0	0		
Chauliodontidae	9	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	45	0	0	0	1	0	20	0	1	0		
<b>Gonostomatidae</b>																												
Diplophos sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Vinciguerrria spp.	0	1	0	3	0	1	0	2	0	2	2	4	3	4	0	6	0	1	36	2	0	29	12	7	22	8		
Cyclothone spp.	0	5	12	1	0	1	0	1	3	1	6	3	1	0	0	3	0	2	4	1	0	4	4	0	1	1		
Gonostoma spp.	0	0	0	0	0	0	0	0	0	0	1	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0		
Polllichthys mauii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Sternoptychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Chauliodontidae	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0		
<b>Gonostomatidae</b>																												
Diplophos sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1		
Vinciguerrria spp.	10	7	5	11	4	0	1	8	1	1	37	2	1	9	1	0	0	0	0	1	46	5	0	8	12	19		
Cyclothone spp.	3	0	0	0	8	0	2	2	0	3	40	16	7	134	0	0	0	0	0	0	0	10	11	3	6	10	22	
Gonostoma spp.	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	
Polllichthys mauii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	
Valenciennellus sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sternoptychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	
Chauliodontidae	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	2

Table 2-1. Cont.

	48-7	49-1	49-2	49-3	49-4	49-5	49-6	49-7	49-8	49-9
Gonostomatiidae										
Diplophos sp.	2	0	0	0	4	2	6	1	3	
Vineiguerria spp.	2	76	29	8	35	32	60	69	84	158
Cyclothone spp.	11	9	1	1	2	13	14	20	17	24
Gonostoma spp.	0	21	1	1	13	4	5	24	1	9
Pollichthys maui	1	2	2	0	0	0	0	0	0	0
Valenciennellus sp.	0	0	0	0	0	0	0	0	0	0
Ichthyococcus sp.	0	0	0	0	0	0	0	0	0	0
Unidentified	4	0	0	2	7	0	0	0	2	1
Sternoptychidae	0	0	0	0	0	0	0	0	0	0
Chauliodontidae	0	0	0	0	3	3	10	18	5	0

Fishes of other families, followed by station number and number of individuals in parenthesis.

Idiacanthidae	11-1(1), 14-1(1), 32-1(1), 32-2(2)
Stomiatiidae	6-5(1), 7-1(1), 10-4(5), 12-1(1), 14-1(2), 18-5(1), 21-1(1), 21-8(2), 23-10(1), 23-12(2), 23-13(1), 25-1(9), 25-4(10), 27-2(3)
	27-6(6), 27-7(1), 27-8(2), 29-4(1), 30-9(1), 31-4(1), 32-1(2), 35-5(1), 45-4(2)
Melanostomiatiidae	8-5(1), 10-4(10), 13-5(1), 14-1(3), 21-12(1), 23-13(3), 25-1(8), 27-8(1), 34-1(1), 49-6(1)
Scopelarchidae	25-1(5)
Cetomimidae	3-1(1)
Melamphidae	3-1(9), 10-4(7)
Astronesthidae	19-1(1)

## 3. OCCURRENCE AND DISTRIBUTION OF LARVAE OF THE SAURY

Y. MATSUMIYA and S. TANAKA

Many plankton net samples have been examined in order to learn about the occurrence and distribution of larvae of the saury, Cololabis saira (BREVOORT), in the south-western part of the North Pacific in relation to their ecological characters.

Larvae of the saury were collected only at night by surface towing a larva net (1.6 m diameter, mesh size in  $0.5 \times 0.5$  mm) at 1.5~2 knots for 10 or 20 min. Sampling stations where saury larvae were collected, the numbers of individuals taken, and the range of body length (the distance between the tip of lower jaw and the posterior end of the muscular knob on caudal base) are as follows :

Station	Number of Individuals	Body length Range (mm)
6-6	5	22~38
7-2	12	9~23
7-3	2	15~31
25-2	1	40
49-2	6	37~60
49-3	6	6~57

The occurrence of saury larva at St. 25-2 ( $23^{\circ}46'N$ ,  $123^{\circ}27'E$ ) is the southernmost record of the distribution. The surface water temperature of the point of collection was  $21.7\sim 23.8^{\circ}C$ .

## 4. STUDIES ON DEEP-SEA SHARKS

K. MIZUE and M. AHMAD

Deep-sea sharks include Darumazame-*Isistius brasiliensis*, Fujikuzira-*Etmopterus lucifer*, Karasuzame *E. pusillus*, etc., and their behaviour has been of absorbing interest. However, it is difficult to determine the best method of gathering the deep-sea sharks. Apparently it is due to the lack of importance of these species for commercial uses and the fact that the fishing gear and methods used in the present fishing operations (say trawl net) do not capture the deep-sea sharks. Deep-sea sharks have occasionally been gathered by benthic-plankton collecting nets. This method of gathering is the most efficient at present. On this expedition of the RV HAKUHO MARU (Cruise KH-73-2) a 39.8 cm male Darumazame was caught by IKMT. This deep-sea shark had already reached his sexual maturity size ; further details of anatomy and histological sections will be examined in the near future.

## 5. DATA ON FISH COLLECTED WITH LARVA NET

H. TSUKAHARA, S. MATSUI, T. HONDA, Y. NONOGAMI and T. OZAWA

Various fish larvae were collected with different types of larva nets during this cruise. Fish species collected were examined and a tentative list of the fish is tabulated in Table 5. Samples noted as KA in this Table show that they have been identified by T. Ozawa in Kagoshima University and KY by members of Kyushu University. Leptocephalid larvae, Myctophids metamorphosed, Gonostomatids, Cololabis saira, Engraulis japonica and Trachurus japonicus are not included in this Table 5 and these will be studied by other scientists.

Table 5-1. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	2-1	2-2	2-3	3-1	3-2	3-3	3-4	4-1	4-2	4-3	5-1	5-2	6-1	6-2
		(KA)	(KA)	(KY)	(KA)	(KA)	(KA)	(KY)	(KA)	(KA)	(KY)	(KA)	(KA)	(KA)	(KA)
Gonorhynchidae						1									
Bathylagidae			1			9	20		17	26		3			2
Stomiidae									1						
Stomias sp.									1						
Astronesthidae						1									
Melanostomiidae		11	6			2	2		2	1		1			
Aulopidae															
Hime sp.							2								
Synodontidae															
Synodus sp.						1									
Trachinocephalus myops						1	3								
Myctophidae		6	42	37		22	499	159	13	458	60	19		10	13
Scopelosauridae												1			
Paralepididae		4						1	2					2	1
Scopelarchidae												3		1	2
Berycida												1			
Berycidae															
Paratrachichthys prosthemius		1													
Melamphidae					12										1
Trachipteridae		1					2			1	1	1	2		
Oreosomatidae															
Scombridae															
Scomber tapeinocephalus							34	6							
Gempylidae		2													
Trichiuridae															1
Diplospinus multistriatus									1			7			11
Lepidopus sp.															3
Benthodesmus sp.												6			
Lepidotidae			1							1		1			2
Carangina							1								
Carangidae		2													
Nomeidae									1			1			1
Pomatomidae										1			1		
Serranidae															
Anthias sp.								2							
Trachinina														1	
Champsodontidae												4			
Callionymidae										2		1			
Bleekeridae							8		1						
Blenniidae						1									
Schindleriidae						1									
Ophidiidae								2							
Carapidae		2							1			2			
Gobiina							3	4							
Pomacentridae							2								
Labrina							1			13					
Labridae		2					8	2	1		3	4		1	1
Scorpaenidae		3				1		2	1	3	1	10			1
Triglidae							5	1	2						
Pleuronectida												1			
Bothidae						2	1		11			3			3
Bothinae		4													
Bregmacerotidae						1	2			1		2			1
Antennariidae		1													
Pterophryne sp.												2			
Antennarius sp.												2			
Unidentified		1		1		3	25	18	7	9	6	7	1		2
Total		40	51	38	12	45	616	219	65	516	71	84	4	15	46

Table 5-2. List of fish larvae collected during Hakuho Maru Cruise KH-73-3.

Species	Stations	6-3 (KA)	6-4 (KY)	6-5 (KA)	6-6 (KA)	6-7 (KY)	7-1 (KA)	7-2 (KA)	7-3 (KY)	7-4 (KA)	8-1 (KA)	8-2 (KA)	8-3 (KY)	9-1 (KA)	9-2 (KA)	9-3 (KA)	9-4 (KY)
Microstomidae																	
Nansenia sp.					1						1			2			1
Bathylagidae																	
Stomiatidae																	1
Astronesthidae				1						1							2
Melanostomiidae				1												2	5
Synodontidae																	1
Trachinocephalus myops				1				2	1								
Myctophidae		7	10	26	38	7	4	9	4	10	7	173	3	27	6	32	
Scopelosauridae				2	4			1			3						1
Paralepididae				1							1						6
Evermannellidae																	1
Scopelarchidae											6			1	1		
Scopelarchus sp.											2						
Melamphidae					1						2						3
Trachipteridae											1	1					
Grammicolepidae																	1
Cempylidae													1				
Trichiuridae																	
Diplospinus multistriatus																3	17
Lepidotidae																	1
Nomeidae											4						5
Pomatomidae		1															
Serranidae													1				
Trachinina					2												
Parapercidae																	2
Bembropidae										1							
Callionymidae											1						
Carapidae											1						1
Pomacentridae					1												
Labridae				19	2		1		2	3	1			5	1		
Scorpaenidae											2	2		4	8		
Bothidae				9			2			4	1			2	8		
Antennariidae																	
Pterophryne sp.																3	2
Antennarius sp.											1						4
Gigantactinidae																	1
Unidentified				1					1		2	1	1	1	3	1	
Total		8	10	64	46	7	7	12	8	19	36	179	4	53	74	39	1



Table 5-3. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations														
	10-1 (KA)	10-2 (KA)	10-3 (KY)	10-4 (KA)	11-1 (KA)	11-2 (KA)	11-3 (KY)	12-1 (KA)	12-2 (KA)	12-3 (KY)	13-1 (KA)	13-2	13-3 (KA)	13-4 (KY)	13-5 (KY)
Bathylagidae					1										
Opisthoproctidae															
Dolichopteryx sp.					1										
Stomiidae															
Stomias sp.								1							
Astronesthidae				2		1									
Idiacanthidae										1					
Melanostomiidae	4	3		6	4	4		3	2				1		
Synodontidae														1	
Trachinocephalus myops				1									1		
Myctophidae	6	16		212	7	37	12	21	2	7	1			17	22
Scopelosauridae	4	1		1	2										
Paralepididae	12	1		18				3			1				4
Evermannellidae	1			7							1				
Scopelarchidae					4			1							
Benthabella sp.				1											
Scopelarchus sp.				12											
Cetomimidae				1											
Taeniophoridae		1							2						
Serrivomeridae				1											
Monognathidae				1											
Exocoetidae															
Exocoetus monocirrus	1							1							
Cypselurus heterurus dodderleini								1							
Berycida				3	1			1							
Melamphidae				13	2										
Rondeletiidae				1											
Trachipteridae						1		1						1	
Gempylidae	1				1	1		1							
Trichiuridae															1
Diplospinus multistriatus	1			28	11			1							
Lepidotidae				1											
Nomeidae				4	13										
Bembropidae				8											
Champsodontidae					4			1							
Draconettidae															
Draconetta sp.				1											
Callionymidae				2											
Ammodytidae															
Ammodytes personatus														1	
Carapidae				1	1										
Eleotridae				2											
Labridae					1						1		1	1	
Aluteridae								1							
Molidae					14										
Scorpaenidae				5	1										
Bothidae				3	1			1			5			11	
Bregmacerotidae				2											
Antennariidae															
Pterophryne sp.				10											
Antennarius sp.				6	4			1							
Melanocetidae				1											
Ceratiidae															
Cryptopsaras couesi															1
Cryptopsaras sp.				5	1										
Linophrynidae								1							
Unidentified				33											12
Total	30	22	0	392	74	46	12	39	6	7	9		3	32	40

Table 5-4. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations															
	14-1 (KA)	14-2 (KA)	14-3 (KY)	15-1 (KY)	15-2 (KY)	15-3 (KA)	15-4 (KY)	16-1 (KA)	16-2 (KA)	16-3 (KY)	16-4 (KA)	16-5 (KA)	16-6 (KA)	16-7 (KA)	16-8 (KA)	
Bathylagidae	1														1	
Stomiidae																
Stomias sp.									2		1		2	1	3	
Astronesthidae														1		
Idiacanthidae	1															
Melanostomiidae	1	1	2			5			1	1	1	1			5	
Synodontidae															1	
Synodus sp.													4			
Myctophidae	52	32	4	31	14	19	8	4	21	2	4	3	3	8	10	
Paralepididae	10			1				1	1		1	2	7	1	5	
Scopelarchidae	2			1				1								
Scopelarchus sp.	2															
Taeniophoridae	2															
Oxyporhamphidae					1	2			1							
Exocoetidae										1						
Exocoetus monocirrhus						1										
Macrorhamphosidae		1														
Berycidae	6															
Caristiidae	1															
Melamphidae	4															
Melamphaes sp.				1												
Trachipteridae	1	1													1	
Sphyracnidae													1	1	1	
Gempylidae	18			4				1							3	
Promethichthys prometeus												4				
Trichiuridae																
Aphanopus sp.								3			1					
Diplospinus multistriatus	6															
Diplospinus sp.				6												
Benthodesmus tenuis				1												
Carangidae																
Decapterus sp.										1						
Trachurops sp.									1							
Nomeidae	11			3				1			1					
Pempheridae													1		1	
Apogonidae								2					1			
Trachininae	13															
Parapercidae				1				1				1		1		
Champsodontidae	1							2								
Blenniidae				1												
Blenniidae											1		2		3	
Carapidae				11							2					
Eleotridae															1	
Pomacentridae									2			1	6	1	22	
Labridae	1			10			2	2	3	2	1	7	13	8	17	
Ostraciantidae																
Ostracion sp.													1			
Tetraodontidae																
Amblyrhynchotes hypselogenion				1												
Molidae	1															
Scorpaenidae	2							1		2	4	2	3	2	17	
Triglidae															1	
Bothidae	2			4				2	1	1	4	8	5	4	4	
Bregmacerotidae	1														1	
Bregmaceros macclellandii							1									
Lophiidae																
Lophiodes sp.				1												
Antennariidae																
Pterophryne sp.	1							1						1		
Antennarius sp.	4														1	
Chaunacidae																
Chaunax fimbriatus				3												
Ceratiinae				1												
Ceratiidae																
Cryptopsaras couesi							1									
Unidentified	5			8	1	3	12	5	2		3	3	7	11	22	
Total	149	35	6	89	16	30	24	27	35	10	24	32	57	40	120	

Table 5-5. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	16-9	16-10	16-11	16-12	17-1	17-2	17-3	18-1	18-2	18-3	18-4	18-5	18-6	18-7	18-8	18-9	18-10
	(KA)	(KA)	(KA)	(KA)	(KY)	(KA)	(KY)	(KA)	(KY)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)
Engraulidae																		
Stolephorus buccaneeri		1																
Stomiidae																		
Stomias sp.		1	1											2				
Astronesthidae									2									
Melanostomiidae		3	6	1	1		4		2	1	2	3	7	6	1	2	1	2
Synodontidae		1																
Synodus sp.									1				1					
Trachinocephalus myops														4		1		
Saurida sp.									1									
Myctophidae		9	6	4	6	6	12	6	96	37	134	26	69	46	43	8	24	6
Scopelosauridae						1			17		2	9	40	46	7	10	3	2
Paralepididae		6	5	4	5	1			18	6		1	17	18	4			2
Evermannellidae									1			1		1				
Taeniophoridae									1									
Hemiramphidae																		
Euleptorhamphus viridis				1														
Exocoetidae																		
Exocoetus volitans							4				1			1				
Exocoetus monocirrus					1						1							
Aulostomidae							1											
Trachipteridae									2				2			1		4
Sphyracnidae			1															
Scombridae															1			
Gempylidae			1			6			1				1					
Trichiuridae											1							2
Diplospinus multistriatus															1			4
Diplospinus sp.							2											
Benthodesmus sp.							2											
Coryphaenidae																		
Coryphaena equisetis																		1
Lepidotidae										1								
Carangidae																		
Decapterus sp.		1	2	1	3													
Nomeidae					1	65			1									1
Apogonidae			1		1													
Trachinina																		1
Parapercaidae			1			1												
Callionymidae													1					
Ammodytidae			1															
Blenniidae					2													
Carapidae														1	1			
Carapus sp.							2											
Gobiina																		3
Electridae			1															
Gobiidae									1					1				
Pomacentridae		4	8	1	4				3							1		
Labridae		5	7	5	1	1			35	1	2	2	7	1	3			3
Acanthuridae																		
Naso sp.				1	1													
Ostraciontidae																		
Ostracion sp.					1													
Scorpaenidae		2	1		1	8									2	1		
Triglidae			1															
Bothidae		4	5	3	21				116		1	31	32	49	28	83	79	43
Bregmacerotidae					1													
Lophiida							4											
Antennariidae																		
Antennarius sp.															2			
Ceratiina											1							
Himantolophidae																1		
Gigantactinidae																		1
Unidentified		4	13		4	7	2	2	2	9	1		1		2			1
Total		41	61	21	54	107	22	8	301	54	145	74	178	176	100	123	136	91

Table 5-6. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	19-1	19-2	20-1	20-2	20-3	20-4	20-5	20-6	20-7	20-8	20-9	20-10	20-11	20-12	20-13	20-14
		(KY)	(KY)	(KA)	(KA)	(KY)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KY)
Gonorhynchidae																	1
Stomiidae																	
Stomias sp.								1	1								1
Macrostomias sp.								1			1						1
Astronesthidae				1				2			3		2	2		1	1
Melanostomiatidae		1	1	17	9		19	11	34	30	14	7	29	15	1	36	11
Synodontidae								1									
Trachinocephalus myops			1														
Myctophidae		20	18	32	39	53	7	122	21	17	342	17	23	50	2	5	15
Scopelosauridae				1			1	1		1			4	7	2	1	
Paralepididae		2	4	2			11	5	5	6	5	1	2	25	1	2	3
Evermannellidae				1			1	2			1		1	2		1	1
Scopelarchidae		6	1														2
Ipnopidae										4							
Nemichthyidae													1				
Exocoetidae								1									
Exocoetus monocirrhus								1									
Exocoetus spp.													2				
Melamphidae																	
Melamphaes sp.		2															
Scopelogadus sp.		1															5
Trachipteridae				1			2	5	3		3		2	3		2	
Gempylidae											1						
Gempylus serpens								5	1	1	4	2	1			1	1
Trichiuridae			3														
Diplospinus multistriatus									1								
Diplospinus sp.			2														
Coryphaenidae																	
Coryphaena equisetis														1		1	
Coryphaena hippurus													1			1	
Lepidotidae					2		5		1								
Carangidae																	
Decapterus spp.				2	2		1			1	2	1	2	1		1	
Nomeidae			2	5					1	1							
Trachinina																	3
Champsodontidae																	2
Champsodon snyderi			2														
Carapidae			1				1										2
Gobiina				1													
Eleotridae								1	2	1	1						
Labridae			1	1				1									
Scorpaenidae			3														
Bothidae				19			50	14	25	57	16	3	32	36	5	49	1
Bothinae			10														9
Bregmacerotidae																	1
Lophiida			2														
Chaunacidae			1														
Melanocetidae																	
Ceratiidae																1	1
Cryptopsarus sp.								1									
Linophrynidae																	
Linophryne arborifera			1														
Himantolophidae										2							
Unidentified		5	13	1				1						1			
Total		37	67	83	52	53	99	175	94	121	393	31	102	143	11	103	60

Table 5-7. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	21-1 (KY)	21-2 (KY)	21-3 (KY)	21-4 (KA)	21-5 (KY)	21-6 (KY)	21-7 (KY)	21-8 (KY)	21-9 (KY)	21-10 (KY)	21-11 (KY)	21-12 (KY)	21-13 (KY)	21-14 (KY)	21-15 (KY)	21-16 (KY)	21-17 (KY)
Gonorhynchidae								1										
Stomiidae																		
Stomias sp.					2													
Melanostomatidae		1	3		3	2		18	8		7	2	6	10	13	6	14	23
Synodontidae																		
Trachinocephalus myops			4		1	7		3	2									1
Myctophidae			30	7	11	11	2	7	2				10	26	6	43	24	17
Paralepididae				1	1	3				1	4		3	6	1	3	2	3
Stemosudis sp.			10			10	1	3	6		2		6					
Evermannellidae																		
Nemichthyidae																1		1
Nemichthys scolopaceus	1																	
Oxyporhamphidae				1														1
Exocoetidae													1					1
Exocoetus sp.				1														
Trachipteridae			1			2		2					1	2		1		2
Gempylidae								2										1
Trichiuridae			1	1														2
Coryphaenidae																		
Coryphaena equisetis												1						
Lepidotidae																		
Lepidotus sp.				1														
Pteraclidae																		
Centropholis petersi				1														
Carangidae																		
Nomeidae											1							1
Blenniina																		1
Brotulidae	1																	
Carapidae																		
Carapus sp.										1								
Labridae			7			2	7	3	1					1				2
Molidae																		
Masturus sp.																		1
Scorpaenidae						1												
Bothidae				2	5			36	24	3	5		6					
Bothinae			36			64	8							8	5	10	3	3
Ceratiina							1	1					1					1
Gigantactinidae																		
Gigantactis sp.									1									
Linophrynidae																		
Linophryne arborifera	1																	
Oneirodidae																		
Chaenophryne sp.					1													
Unidentified		1	3			2							1		1			
Total		5	95	15	24	104	19	76	44	5	19	3	35	53	27	68	46	54

Table 5-8. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations															
	22-1 (KA)	22-2 (KA)	22-3 (KY)	23-1 (KY)	23-2 (KA)	23-3 (KY)	23-4 (KY)	23-5 (KY)	23-6 (KY)	23-7 (KY)	23-8 (KY)	23-9 (KY)	23-10 (KY)	23-11 (KA)	23-12 (KY)	23-13 (KY)
Opisthoproctidae																
Dolichopteryx sp.	1															
Stomiidae																
Stomias sp.	1													2		
Macrostomias sp.	1															
Melanostomiidae	4	2		3				2	4	5	2	7	6	3	2	6
Synodontidae																
Synodus sp.									2	2						1
Myctophidae	6	8	5	12	70	236	24	16	6		20	4		9	10	
Scopelosauridae	7															
Paralepididae								2			1	3		1	1	1
Evermannellidae				1					1							
Taeniophoridae							1									
Oxyporhamphidae	1	18	3		1											
Exocoetidae			28				1						1			
Exocoetus volitans			3													
Exocoetus monocirrhus	1	21														
Exocoetus sp.											1					
Cypselurus poecilopterus			1													
Holocentridae															1	1
Trachipteridae	1													1	2	
Trachipterus sp.				1						3		1	2			
Grammicolepidae	2															
Sphyraenidae							1									
Sphyraena sp.																
Scombridae																
Katsuwonus pelamis					1											
Rastrelliger sp.	1															
Gempylidae				4	1	3	2	1	1		1	11	1			3
Trichiuridae																
Diplospinus multistriatus	1															
Aphanopus sp.	1															
Coryphaenidae													1			
Coryphaena equisetis											1					
Coryphaena hippurus			1							1						
Nomeidae				2												
Cubiceps sp.	2															
Apogonidae																
Apogon sp.								1					1			2
Gymnapogon sp.												1				1
Serranidae				24		2	4	4			5	1	1			
Epinephelus sp.									1							1
Champsodontidae	1															
Draconettidae																
Draconetta sp.	1															
Blenniidae				3				2	2	1		1				
Carapidae	3							1								
Gobiidae								2				1	2		1	1
Pomacentridae								2	1							
Labridae	3			3				4	16	4		3	1	1	2	5
Acanthuridae																
Naso sp.									2				2			
Tetraodontidae								1								
Diodontidae																
Diodon holacanthus											1					
Diodon sp.													1			
Molidae				2												
Scorpaenidae	3			1		1		6	1	1	1	1			4	1
Setarches fidjiensis												1				
Bothidae	3			5			4	3	11	2	4	8	4	3	15	6
Bothinae																
Cynoglossidae																
Symphurus sp.				1								1				
Bregmacerotidae				8												
Ceratiina							1						1		4	1
Gigantactinidae	1	3														
Unidentified	3	2		2	10	6	6	11	3	1	5	2		1	4	
Total	48	59	36	72	83	250	55	70	42	12	51	34	13	22	62	12

Table 5-9. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	24-1	24-2	24-3	25-1	25-2	25-3	25-4	25-5	25-6	25-7	25-8	25-9	25-10	26-1	26-2	26-3
	(KA)	(KA)	(KY)	(KY)	(KA)	(KY)	(KY)	(KY)	(KY)	(KY)	(KY)	(KY)	(KY)	(KY)	(KA)	(KA)	(KY)
Argentinidae																	
Glossanodon sp.		1															
Bathylagidae		1															
Opisthoproctidae																	
Dolichopteryx sp.															1		
Stomiidae																	
Stomias sp.						1											
Astronesthidae																	2
Melanostomiidae		2	1	4				1				1					1
Synodontidae																	
Synodus sp.						2											
Trachinocephalus myops						1											
Myctophidae		32	18	20	47	66	26	18	5	1	1				6	11	3
Scopelosauridae		19				1										8	
Paralepididae		4		1	14			16	1					1		2	
Scopelarchidae		4						1								2	
Oxyporhamphidae																	1
Exocoetidae													1	1			11
Exocoetus volitans			2														
Exocoetus monocirrhus															1	7	
Exocoetus sp.						1									1	2	
Holocentridae						1											
Melamphaidae						2											
Trachipteridae						1											
Grammicolepidae		1															
Gempylidae								1	1								
Trichiuridae																	2
Diplospinus multistriatus																	1
Benthodesmus sp.		2															1
Lepidotidae		1															1
Carangidae																	
Decapterus sp.		1															
Nomeidae																	
Champsodontidae																	1
Champsodon snyderi						1											
Draconettidae																	
Draconetta sp.																	1
Brotulidae						1											
Carapidae		2															
Gobiina		1															
Pomacentridae		1															
Labridae		4			1			2									
Acanthuridae																	
Naso sp.					1												
Tetraodontidae								1									
Scorpaenidae			1		1												
Setarches fidjiensis					1												1
Bothidae		96															1
Bothinae					86			6	3		1						1
Moridae														2			
Bregmacerotidae					3												1
Lophiina								1									
Antennariidae																	
Antennarius sp.																	1
Chaunacidae																	
Chaunax fimbriatus					2												
Ceratiina					1												
Unidentified		3		2	5	6	23	4	1						1	2	
Total		175	22	27	171	75	51	49	11	1	2	1	1	4	35	22	15

Table 5-10. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	27-1 (KY)	27-2 (KY)	27-3 (KY)	27-4 (KY)	27-5 (KA)	27-6 (KY)	27-7 (KY)	27-8 (KY)	27-9 (KY)	27-10 (KY)	27-11 (KY)	27-12 (KY)	27-13 (KY)	29-1 (KA)	29-2 (KA)	29-3 (KY)	29-4 (KA)
Opisthoproctidae																		
Dolichopteryx sp.																1		
Stomiidae																		
Stomias sp.						6									4	4		1
Astronesthidae						1										2		
Melanostomiidae				9	2	2	9		4	7	5	1		5	3			
Synodontidae																		
Synodus sp.				1			2											
Trachinocephalus myops						1						1		1				
Myctophidae			44	23	167	390	12	8	4	2	3	1		1	13	7	2	5
Scopelosauridae						16									4			
Paralepididae	1	8	54	16	15	66	53	18	11	12	5	1	6					2
Evermannellidae				4														
Scopelarchidae		1													1		1	
Oxyporhamphidae																2		
Exocoetidae																		
Exocoetus volitans				1		1	1								1			
Cypselurus naresii																	1	
Fistulariidae																		
Fistularia villosa					2													
Berycida															4			
Holocentridae															1			
Polymixiidae																		1
Scombridae																		
Katsuwonus pelamis						1												
Trachipteridae				2	1		1	1							3	1	2	
Gempylidae		5	1	4	3	3	5	2	3	1			1	6	8			
Gempylus serpens															5	2		
Neolatus tripes																		
Trichiuridae				1		3												
Benthodesmus sp.															3			
Coryphaenidae			1												1			
Lepidotidae	1																	
Carangidae																		
Decapterus sp.									1						1			
Nomeidae															3	1		
Mullidae																		1
Upeneus sp.										1								
Apogonidae		1							1						1			
Serranidae					6										2			
Döderleininae			2															
Serraninae			12															
Epinephelinae																		
Epinephelus sp.				2														
Lutjanidae																		
Lutjanus sp.							1				1							
Chiasmodontidae																	1	
Blenniidae		1																
Pomacentridae					1	1			1					1	7	1		
Carapidae				3										1				
Labridae		4	14	3	2	6			1	1				3	3		1	1
Chaetodontidae																		
Forcipiger sp.												1						
Acanthuridae																		
Acanthurus sp.																	4	
Balistidae														2				
Aluteridae					1													
Molidae																		
Scorpaenidae		1				1									10			
Echeneidae															6			
Phtheilichthys lineatus							1											
Gobiesocidae																	1	
Bregmacerotidae			1							1								
Bothidae																	6	
Bothinae			1	6		20	3	3		1	1							
Crossorhombus sp.														5				
Lophiina			1															
Ceratiina			1															
Unidentified		9	5	1	16	1	1	1		1	1			1	20	4		1
Total		2	93	128	203	458	125	68	33	27	24	11	1	27	123	26	7	11



Table 5-11. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	30-1 (KY)	30-2 (KA)	30-3 (KY)	30-4 (KY)	30-5 (KY)	30-6 (KY)	30-7 (KY)	30-8 (KY)	30-9 (KY)	30-10 (KY)	30-11 (KY)	30-12 (KY)	31-1 (KA)	31-2 (KA)	31-3 (KY)	31-4 (KA)
Bathylagidae																
Stomiidae																1
Stomias sp.													38	8		1
Macrostomias sp.													1			
Astronesthidae			1										10			1
Idiacanthidae													2			3
Melanostomiidae					2		46	5	1				13			1
Synodontidae									1				1			
Synodus sp.						1			1					1	3	
Saurida sp.													1			
Myctophidae	25	82	64	3	85	11		4	3	9	2	170	308	159		20
Scopelosauridae												32				
Paralepididae	2			5	10	3	1					6	2	3		
Evermannellidae					3							1				
Scopelarchidae												2				
Taeniophoridae												1	2			
Oxyporhamphidae				1				1					1		1	
Exocoetidae																
Exocoetus volitans			1													
Cypselurus poecilopterus			1													
Berycida													1			
Holocentridae														1		
Melamphidae													1			1
Trachipterina															1	
Sphyraenidae														4		
Scombridae	1			3	8	1		1	1							
Thunnus albacares													1		1	
Katsuwonus pelamis															1	
Auxis sp.						3						2	106	51		
Gempylidae	4	2		1	6	2		1				4	1	1	1	
Promethichthys prometheus												1				
Trichiuridae												3	1	1		
Diplospinus multistriatus												3				
Coryphaenidae	1											1	1			
Coryphaena equisetis		4														
Lepidotidae						1						1	2			
Carangidae													3			
Decapterus sp.	2											1				
Caranx sp.						1										
Seriola sp.										1						
Leiognathidae														1		
Nomidae													2			
Icticus sp.												9	51			
Mullidae												1				
Apogonidae									1						1	
Serranidae													3	5		
Epinephelus sp.	1															1
Serraninae				1	2											
Paraperidae																1
Uranoscopidae													1			
Callionymidae														1		2
Bleekeridae												2				
Bleniidae												1	1			
Schindleriidae														1		
Brotulidae																
Monothrix polylepis												1				
Carapidae																
Carapus sp.	1															
Gobiina	1													15	6	
Pomacentridae														5	3	
Labridae	1				8	1							1	1		
Acanthuridae																
Acanthurus sp.																
Naso sp.	1												1			
Balistidae													3			
Tetraodontidae															1	
Molidae	8			2				1					1			
Scorpaenidae				1	1								2			
Platycephalidae													1			
Echeneidae	1		1													
Bothidae													11	1		1
Bothinae																
Engyproson sp.	19			126	264	157	72	60	52	44	31				1	
Cynoglossidae													1			
Bregmacerotidae													1			2
Antennariidae													4	2		1
Pterophryne sp.																
Antennarius sp.													8			
Melanocetidae																
Unidentified	15			1	2	3		1					27	42	55	
Total	89	91	67	145	390	233	78	72	57	54	34	1	378	571	288	39

Table 5-12. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	32-1 (KA)	32-2 (KY)	34-1 (KA)	34-2 (KA)	34-3 (KA)	34-4 (KA)	35-1 (KY)	35-2 (KY)	35-3 (KY)	39-1 (KA)	39-2 (KY)	39-3 (KA)	39-4 (KA)	39-5 (KA)	39-6 (KA)
Dussumieridae																
Etrumeus micropus								6								
Engraulidae																
Stolephorus sp.										2					3	
Alepocephalidae		1														
Stomiidae																
Stomias sp.				4												
Macrostomias sp.				1												
Astronesthidae				2												
Idiacanthidae		1														
Melanostomiidae			5	1	6	1	1	3					1			1
Synodontidae										9						
Synodus spp.			1					3	17	7	3		42		43	90
Trachinocephalus myops			4					10	10		2		3		9	20
Saurida sp.			1								11		1	1	1	21
Myctophidae		22		15	19	1	3	12	3	5	13	10	11		16	18
Scopelosauridae		1														
Paralepididae				2	2	1		4	2				7		7	14
Scopelarchidae																
Taeniophoridae																
Oxyporhamphidae			1	6								1	10		5	
Exocoetidae													8			
Exocoetus volitans			1	1			1				1					
Exocoetus monocirrhus															5	
Cypselurinae								1								
Hirundichthys oxycephalus															1	
Prognichthys agoo									1							
Fistulariidae				1	1											
Caristiidae				2												
Melamphidae				1												
Trachipteridae				1	1	1			1	1	1				1	2
Regalecidae					1											
Sphyraenidae																
Sphyraena sp.			1					1								
Scombridae										1						
Euthynnus sp.										1	1					
Katsuwonus pelamis			1		1					1						
Auxis sp.					4	5	2	5	10	19	6	13	31	2	12	32
Scomber sp.								2	1	1						
Rastrelliger sp.											1		4	2	2	6
Gempylidae															1	1
Gempylus serpens				2												
Trichiuridae										1			1			
Benthodesmus sp.				4												
Coryphaenidae									1							
Coryphaena equisetis													2			
Coryphaena hippurus										3			3			
Lepidotidae				1			1		1		1					
Carangidae									3	3		1				
Decapterus sp.									15	1			2	1	3	5
Caranx sp.											1				2	7
Naucrates sp.														1		
Stromateina								5								
Stromateidae													1			
Nomeidae				26	2											
Mullidae					1				5	2	9	1	5			1
Cepolidae											1	1	8			
Apogonidae			2		2	1	2	1			1	2	2	4	3	3
Siphamia sp.													3			
Serranidae					1	1							1		2	
Bembropidae												78	109		8	4
Champsodontidae													3			
Callionymidae		1											1			
Bleekeridae											1					
Blenniidae			1		4	2		1					1		1	
Schindleriidae													1			
Gobiina			1					1		1			4		4	10
Eleotridae											5		2		1	
Pomacentridae										1						
Labridae			20	1	1		1			2			5	2	1	2
Chaetodontidae						1										
Aluteridae														1		
Ostraciontidae													1			
Tetraodontidae			1	4				1								
Scorpaenidae			1			1		1			1		2			1
Bothidae				8	15	17	10				17		44	1	24	32
Paralichthinae																
Paralichthys sp.										1						
Bothinae								163	344	604			2			
Arnoglossus japonicus			52													
Cynoglossidae			3													
Cynoglossinae									1							
Soleina														1		
Bregmacerotidae									2			6	1	5	10	15
Bregmaceros nectabanus									2							
Antennariidae										1						
Pterophryne sp.				2												
Antennarius sp.				5				4	5	5	1				2	
Melanocetidae				1											1	
Unidentified		2		4	2	2		3	4	2	13		10	5		1
Total		28	97	102	63	33	21	250	407	673	176	56	313	28	157	286

Table 5-13. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	39-7 (KA)	39-8 (KA)	39-9 (KA)	39-10 (KA)	39-11 (KA)	41-1 (KA)	41-2 (KA)	41-3 (KY)	41-4 (KA)	44-1 (KA)	44-2 (KA)	44-3 (KA)	44-4 (KA)	44-5 (KY)	44-6 (KY)
Dussumeriidae																
Etrumeus sp.								1		12						
Dussumieria sp.		3				2		10	1	5						
Stomiidae									1							
Stomias sp.																1
Melanostomiidae										2					1	1
Aulopidae																
Hime sp.		1	1													
Synodontidae									13							
Synodus spp.		46	39	48	31	34				1	1			3	2	
Trachinocephalus myops		8	7	5	5	3		1		3					1	2
Saurida sp.		30	11	11	4	4	1	15		25						
Myctophidae		11	38	19	8	1	2	46	17	24	10	25		17	9	13
Paralepididae		6	18	27	19	14			1		8	7		13	9	5
Taeniophoridae															1	
Oxyporhamphidae								3							4	1
Exocoetidae																1
Exocoetus volitans								1			1	1				
Cypselurinae																1
Fistulariidae									4					1		
Zeidae							1									
Scombridae										2						
Katsuwonus pelamis								2	1							
Auxis sp.		11	9	5	5	8	1	31	6	12						
Scomber tapeinocephalus							3									
Scomber sp.									28							
Rastrelliger sp.		2	1	2	1	1				21						
Gempylidae		1		1												
Trichiuridae			2	2				3		2						
Coryphaenidae								2								1
Coryphaena hippurus																2
Lepidotidae											1	2				
Carangidae			3	1				1	8							
Decapterus sp.		2	1		8	5	1	8		2						
Caranx sp.		10	9	12	14	26										
Leiognathidae							5	32		56		2				
Nomeidae			2	7	6		1			5						
Icticus spp.		1		1		2										
Pempheridae												1				
Mullidae			6	10	4	7										
Upeneus sp.																1
Cepolidae		1	4	9	2					3						
Branchiostegidae		2	3	2												
Apogonidae		6	22	24	12	4	1	4		10						
Siphamia sp.						1										
Serranidae		2	1	1	2					1						
Bembropidae		7	71	82	6	5										
Champsodontidae		1	1	4		1		18	3	5						
Callionymidae			1	3			6	22	10	29						
Bleekeridae			1					9		2						
Schindleriidae						1										
Carapidae		1			1									1		
Carapus sp.																2
Gobina		3	11	11	5	2			75							
Gobiidae							2									
Eleotridae		1					14	109		87		1				
Pomacentridae						2										
Labridae		1						1	4	10	3	4		3	7	1
Acanthuridae																
Acanthurus sp.												1				
Aluteridae				1												
Tetraodontidae																
Diodontidae										1						1
Scorpaenidae		1	3	2		1				2				1		
Platycephalidae								1		3						
Hoplichthyidae			1	2												
Triglidae			1	1	1		3	3	17	3						
Bothidae		11	9	11	6	7	9	7	2	7	2	2		18	6	8
Bothinae										3					2	7
Arnoglossus japonicus																1
Cynoglossidae														1		
Bregmacerotidae		10	9	7	9	3	6	59	41	33						
Antennariidae																
Antennarius sp.										2						
Melanocetidae						1				1						1
Ceratiidae																
Cryptosaras sp.								1								
Himantolophidae							1			1						
Unidentified		7	25	13	3	2		44	41	2	2	1			1	
Total		186	310	324	152	137	57	435	277	374	29	44		60	49	44

Table 5-14. List of fish larvae collected during Hakuho Maru Cruise KH-73-2.

Species	Stations	44-7	44-8	44-9	44-10	44-11	44-12	44-13	44-14	44-15	44-16	44-17	44-18	45-1	45-2	45-3	45-4
		(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KA)	(KY)	(KA)	(KA)			(KA)	(KA)	(KY)	(KA)
Dussumieridae																	
Etrumeus sp.										4							
Clupeidae								1			1			1			
Sardinella sp.										1							
Engraulidae																	
Stolephorus sp.														2		1	1
Stomiidae																	
Stomias sp.			1					2			2			7			
Astronesthidae														2			
Melanostomiidae								2						2			1
Synodontidae																	
Synodus sp.		1					1										
Trachinocephalus myops		3						7			3			1			
Saurida sp.							1										
Myctophidae		7	7	7	9	2	55	121	10	24	12			59	170	5	54
Paralepididae		9	12	20	10	5	1	3			3			2	1		1
Scopelarchidae								1									2
Hemiramphidae																	
Euleptorhamphus viridis																	
Oxyporhamphidae				1				2	2	5	4			1		1	3
Exocoetidae																	
Exocoetus volitans								1	2					1	3		
Exocoetus monocirrus								1			1					2	
Exocoetus sp.											1						
Cypselurus poecilopterus											1						
Prognichthys sp.								1			1						
Syngnathidae										1							
Holocentridae											1			4	2		
Trachipteridae								2		2	2			1		2	1
Sphyraenidae															1		
Scombridae																	
Thunnus albacares															1	3	
Thunnus obesus								1						1			
Thunnus sp.										1							
Euthynnus affinis yaito								2	2								
Katsuwonus pelamis							1	23	25	4	7			47	62	35	6
Auxis sp.								2	1					88	153	76	6
Scomber tapeinocephalus									2								
Scomber sp.								3	29			3					
Rastrelliger sp.										39							
Gempylidae																	
Coryphaenidae										3				8	3		
Coryphaena equisetis											1			12	6	2	
Coryphaena hippurus								1	1	1	6	5					
Lepidotidae								8						5	5	3	1
Stromateidae										5							
Carangidae										6				3	1		
Seriola sp.								1	2					1			
Leiognathidae																	
Nomeidae		1						36	1	6	8			14	76		5
Mullidae								3		6	1				3	4	
Upeneus sp.									6								
Cepolidae														1			
Apogonidae							1		1					9	1		1
Serranidae														2			
Serraninae																1	
Trachinina						2											
Blenniidae																1	
Blennius sp.										1							
Carapidae										1							
Gobiina			1							1				5		3	
Eleotridae								1			1				6		
Pomacentridae								4						5	1	1	
Chromis sp.									1								
Labridae		2		1	1			2				1		3	1	1	
Chaetodontidae															4		
Acanthuridae															2		
Acanthurus spp.				1											1		
Naso sp.																	
Tetraodontidae				1	2												1
Scorpaenidae				1				1	1					4	5	1	
Cephalacanthidae														3			
Bothidae		7	6	3	4		2	8		2	10			27			1
Bothinae																1	
Chascanopsetta sp.								1				1					
Cynoglossidae									1								
Bregmacerotidae		1				1	1	3	2								2
Bregmaceros macclellandi									1								
Antennariidae																	
Pterophryne sp.															1		
Antennarius sp.																	
Melanocetidae									1								
Ceratiidae														1			
Cryptopsaras couesi																	
Himantolophidae																	1
Oneirodidae														1			
Unidentified				2	2		1	5	3	11	3			24	8	60	2
Total		31	28	37	28	10	66	251	110	112	71			352	520	202	86



Appendix for Table 5

Species	13-5	19-1	19-2	20-3	21-2	21-5	21-15	22-3	27-2	27-4	31-3	46-4
Engraulidae												
Stolephorus sp.												1
Bathylagidae				1	1	2	1	1				
Opisthoproctidae												
Dolichopteryx sp.		1										
Conostomatidae										1		1
Diplophos sp.		1										
Mangrethia sp.			1									
Maurolicus sp.		1	2	3								
Chauliodontidae												
Chauliodus sp.		1			1							
Gobiidae												
Total	1	5	4	1	3	2	1	1	1	1	1	1

## 6. ANGUILLID ELVER

O. TABETA and T. TAKAI

An anguillid elver was collected in the water between the southernmost part of Taiwan and Hong Kong with 4-meter-diameter net on the evening of March 10, 1973.

MATERIAL EXAMINED. One specimen; KH-73-2, Station 39-1; 21°56.5'N., 116°42.0'E.; March 10, 1973 (1846-1924); horizontal tow in 75 m wire out with wire angle 69°; ship speed 1.5 knots; towing duration 30 min.; 4 m net.

DESCRIPTION. Measurement of the preserved specimen (mm) : total length 54.2, body length 53.1, predorsal length 15.2, preanal length 20.0, head length 5.6. Vertebral counts determined by means of X-ray photograph : total vertebrae 114, abdominal vertebrae 42, predorsal vertebrae 28, anodorsal vertebrae 8. Body elongate, cylindrical; branchiostegal rays obvious; fin ray clearly visible; pectoral 18. Head short, about one-tenth; snout short, lower jaw protruding. When taken from the net on board the specimen was entirely colorless except for black pigment confined to chorioid of the eye and minute pigment faintly scattered on the caudal region. These minute chromatophores completely disappeared during three months preservation in 10% solution of neutralized formalin with borax.

On the basis of vertebral counts this elver is to Anguilla japonica. Following this collection, plankton tows were made with the same net in the surface (3 times), middle (3) and deep (1) layers of this station, and 104 leptocephali and elvers belonging to Congridae, Echelidae Ophichthyidae, Nettastomidae, Muraenidae, Xenocongridae and Elopina were obtained. No further leptocephalus nor elver referable to Anguilla were obtained. This seems to be the first record of the offshore capture of the elver of A. japonica in this marginal area.

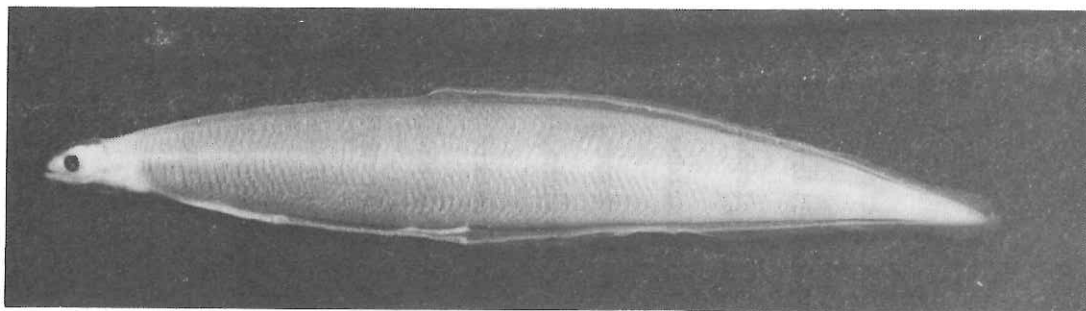


Fig.7-1. Anguilla japonica, 52.7mm in total length  
KH-73-2, Stn.30.

## 7. ANGUILLID LEPTOCEPHALUS

M. NISHIWAKI, T. TAKAI and O. TABETA

An anguillid leptocephalus was collected in the waters south of Taiwan with the net of 4-meter-diameter on the evening of March 7, 1973.

MATERIAL EXAMINED. One specimens; KH-73-2, Station 30-8; 21°01.4'N., 121°00.8'E.; March 7, 1973 (2107-2140); horizontal tow in 75 m wire out with wire angle 69°; ship speed 1.5 knots; towing duration 30 min.; 4 m net.

DESCRIPTION. Measurement of the preserved specimen in 10% solution of neutralized formalin with borax (mm): total length 52.7, head 4.9, snout 1.1, eye 0.9, upper jaw 1.6, postorbital 3.1, pectoral 1.2, preanal 22.5 predorsal 20.5, depth at pectoral origin 3.2, depth at anal origin 8.2. Branchiostegal rays not obvious; fin rays visible clearly; dorsal ca. 250, anal ca. 210, pectoral 18 and caudal 10. No teeth. Total myomeres 115 (anterior from last vertical blood vessel 44 and posterior from last vertical blood vessel 69), predorsal 40 and ano-dorsal 5. 1st vertical blood vessel at 15th, 2nd at 37th and 3rd (last) at 44th myomere.

Body elongate, not so compressed nor very deep, rather cylindrical and tapering a little more gradually in front of midpoint of body. Head short, about one-ninth of total length, head region clearly differentiated from the trunk; snout short, equal to one-fourth of head; nostrils well developed, and front nasal tubes protruding; eye moderate, oval; gape oblique, extending to level of midpoint of eye; rays in each fin well recognizable through binocular; caudal fin conspicuously separated from the tips of the dorsal and anal fins. Color in the preserved specimen translucent, with black pigment confined to chorioid of the eye.

This metamorphosing specimen belongs unquestionably to Anguilla japonica T. et S.



## 8. LEPTOCEPHALI COLLECTED THROUGH THE CRUISE OF KH-73-2

T. TAKAI and O. TABETA

Leptocephalus larvae were collected at various depths from the surface down to 5,000 meters with 4-meter-diameter net, standard fish larva net, ORI-100 net, and IKMT at 39 station. Excluding anguillid elver and larva, the results obtained are shown in Table 1.

These leptocephali appeared in 180 of 243 nets at 39 stations and numbered 4,997 specimens. Most of them belong to Anguillida (4,991 specimens); the remnants are referable to Clupeida (4 specimens) and Notacanthida (2 specimens). Anguillida leptocephali represent 12 families such as Congridae (4,312 specimens : 86% of total specimens), Nemichthyidae (384 specimens : 7.7%), Ophichthyidae & Echelidae (157 specimens : 3.1%), Nettastomidae (56 specimens : 1.1%), etc. Nettastomidae includes 52 specimens of Saurensheleyidae (D'Ancona 1928) and 4 specimens of Nettastomidae (Castle 1964). Congridae is the most abundant family with more than 20 species, the conspicuous genera of which are Rhynchocymba (1571 specimens of 2 species) and Alloconger (1518 specimens of more than 6 species).

The results of tentative analysis are summarized as follows : (a) The leptocephali were collected mainly from sunset to midnight throughout the cruise. (b) In the waters adjacent to the Ryukyu Islands, Rhynchocymba (Congridae) was the most common species at the near-shore stations; on the contrary, Alloconger (Congridae) became predominant at the offshore stations. (c) Alloconger was found abundantly and Rhynchocymba was rather scarce at the stations of the continental shelf of China Mainland. In these waters an endemic species belonging to Congridae was recognized. (d) Nemichthyidae was not collected at the stations from 35 to 43 located on the continental shelf. (e) Elvers of Echelidae were obtained abundantly at the station 39. (f) Leptocephali of Cyemidae and Xenocongridae are considered to be the first record for the North West Pacific. (g) Cyemidae and Synphobranchidae were noticed only in the waters of the Ryukyu Deep and its adjacent area.





Table 8-1. Cont.

Station No.	ANGUILLIDA											CLUPEIDA	NOTACANTHIDA	Total		
	Congridae	Nemichthyidae	Echelidae & Ophichthyidae	Nettastomidae*		Muraenidae	Xenocoelidae	Cyemidae	Synphobranchidae	Moringidae	Anguillidae	Elopina	Halosaurina		Unidentified	
32	2	324	2	7	A	B									335	
34	1	32	4	5		10		2				1			54	
34	2	65		5											70	
34	3	98		5							1				104	
34	4	60		10											70	
35	1	52		3		5	1								61	
35	2	7		2		4	1								14	
35	3	17		2											19	
39	1			1							1			1	3	
39	2					2									2	
39	3	10		5		1									16	
39	4			1		1									1	
39	5	8		2			2								12	
39	6	17		9		2		1			1				30	
39	7	7		12		2									21	
39	8	2		3											5	
39	9	4	1			3									8	
39	10	4			1										5	
39	11	2				1									3	
41	1			2											2	
41	2													1	1	
41	4	7		12			2								21	
44	1	35		2		1									38	
44	2	16													16	
44	3	57													57	
44	4	61	3	1		3	2							1	71	
44	5	7		2											9	
44	6	22	1	1		1									25	
44	7	53		1			1								55	
44	8	3		1			2								6	
44	9	61		2				1							64	
44	10	20	1	1		1					1				24	
44	11	27													27	
44	13	16				1									17	
44	14	1													1	
44	15	2													2	
44	16	9													11	
44	17	13		1							1				13	
44	18	7	1			1	1								10	
45	1	72		10		1									83	
45	2	7													7	
45	3	3													3	
45	4	4	1												5	
46	1	17		1											18	
46	2	2													2	
46	3	8		1		1									10	
46	4	81		6											87	
46	5	52		10											62	
48	1	10	5											1	16	
48	2	1													1	
48	4	11	6												17	
48	5	13	1												14	
48	6	37	5												42	
48	7	10	1												11	
49	1	7	2												9	
49	4	1		1											2	
49	5	5													5	
49	6	4	3												7	
49	7		10			1									11	
49	8	2	2												4	
49	9	4	2												6	
Beam trawl																
42	2	1													1	
44			1												1	
Total		4312	384	157	4	52	33	22	9	8	3	1	4	2	7	4998
(%)		(86.4)	(7.7)	(3.1)	(1.1)	(0.7)	(0.4)	(0.2)	(0.2)	(-)	(-)	(-)	(-)	(-)	(-)	

\* Nettastomidae A indicates Castle's Nettastomidae (1964).

Nettastomidae B indicates D'Ancona's Saurenhelyidae (1928).

9. NOTE ON LANTERNFISHES ( FAMILY MYCTOPHIDAE )  
FROM POST - LARVAL STAGE ONWARD

T. KUBOTA and F. SATO

The total number of myctophids collected by the various net methods at 243 stations was 4,106 specimens. At 16 of 52 stations, 493 specimens of myctophids were collected in daytime (0600-1800) and at 139 of 191 stations, 3,613 at night (1800-0600).

Tows were made with a larval net with diameter of 1.6 meter in the surface layer at 27 stations in the daytime but no myctophids were collected. However at 24 of 47 stations sampled at night, 231 myctophids were collected with this net. Myctophids collected by larval net were identified as belonging to the following nine species. The numerals in parenthesis show the number of specimens of each.

<u>Hygophum reinhardti</u> (Lutken)	( 20)
<u>H. proximum</u> Becker	( 8)
<u>Myctophum nitidulum</u> Garman	( 13)
<u>M. asperum</u> Richardson	( 8)
<u>M. spinosum</u> (Steindachner)	( 16)
<u>M. obtusirostrum</u> Taning	( 21)
<u>Symbolophorus evermanni</u> (Gilbert)	(137)
<u>Centrobranchus brevirostris</u> Becker	( 7)
<u>Myctophum</u> sp.	( 1)

Of the above mentioned species, the occurrences of Hygophum proximum were locally distributed in the south-western area of Formosa (Sts. 44 and 45), specimens ranging from 14.1 to 15.5 mm in body length.

Myctophids collected by methods other than a larval net will be identified later. For certain of these fishes, a small number of large-sized specimens will be investigated for food organisms in stomach contents.

Table 9-1. Number of specimens of lanternfishes (post-larval stage onward) collected in KH-73-2 cruise.

Stn.	Date	No. of specimens	Stn.	Date	No. of specimens	Stn.	Date	No. of specimens	Stn.	Date	No. of specimens
1973			1973			1973			1973		
2-1	2-22	149	17-1	3-1	0	25-3	3-5	9	41-3	3-17	0
2-2	2-23	7	17-2	"	0	25-4	3-6	38	41-4	"	0
2-3	"	13	17-3	"	0	25-5	"	13	44-1	3-18	3
3-1	2-23	7	18-1	3-1	36	25-6	"	8	44-2	"	0
3-2	"	11	18-2	"	0	25-7	"	37	44-3	"	0
3-3	"	6	18-3	"	2	25-8	"	1	44-4	"	5
3-4	"	1	18-4	"	2	25-9	"	19	44-5	"	0
4-1	2-24	16	18-5	"	73	25-10	"	1	44-6	"	5
4-2	"	0	18-6	"	7	26-1	3-6	1	44-7	"	5
4-3	"	1	18-7	3-2	49	26-2	"	0	44-8	"	0
5-1	2-24	0	18-8	"	28	26-3	"	0	44-9	3-18	7
5-2	"	0	18-9	"	31	27-1	3-6	12	44-10	3-19	1
5-3	"	0	18-10	"	8	27-2	"	10	44-11	"	0
6-1	2-24	12	19-1	3-2	22	27-3	"	48	44-12	"	1
6-2	"	0	19-2	"	0	27-4	"	1	44-13	"	36
6-3	"	0	20-1	3-2	0	27-5	"	7	44-14	"	4
6-4	"	0	20-2	"	0	27-6	"	75	44-15	"	30
6-5	"	27	20-3	"	0	27-7	"	20	44-16	"	103
6-6	"	0	20-4	"	12	27-8	3-6	2	44-17	"	71
6-7	"	1	20-5	"	47	27-9	3-7	13	44-18	"	23
7-1	2-25	82	20-6	"	9	27-10	"	13	45-1	3-19	21
7-2	"	46	20-7	"	54	27-11	"	20	45-2	3-20	4
7-3	"	6	20-8	"	51	27-12	"	2	45-3	"	0
7-4	2-26	125	20-9	"	5	27-13	"	14	45-4	"	31
8-1	2-26	20	20-10	3-3	7	29-1	3-7	0	46-1	3-20	6
8-2	"	0	20-11	"	129	29-2	"	0	46-2	"	0
8-3	"	0	20-12	"	1	29-3	"	0	46-3	"	0
9-1	2-26	30	20-13	"	21	29-4	"	1	46-4	"	16
9-2	"	7	20-14	"	34	30-1	3-7	0	46-5	"	36
9-3	"	0	21-1	3-3	10	30-2	"	0	48-1	3-22	14
9-4	"	0	21-2	"	18	30-3	"	0	48-2	"	1
10-1	2-26	26	21-3	"	3	30-4	"	0	48-3	"	0
10-2	"	0	21-4	"	0	30-5	"	3	48-4	"	19
10-3	"	0	21-5	"	23	30-6	"	13	48-5	"	17
10-4	2-26	293	21-6	"	2	30-7	"	10	48-6	"	16
	2-27		21-7	"	13	30-8	"	1	48-7	"	4
11-1	2-27	1	21-8	"	2	30-9	"	8	49-1	3-23	22
11-2	"	0	21-9	3-3	5	30-10	"	10	49-2	"	4
11-3	"	0	21-10	3-4	3	30-11	"	9	49-3	"	3
12-1	2-27	18	21-11	"	3	30-12	3-7	0	49-4	"	10
12-2	"	0	21-12	"	7	31-1	3-8	53	49-5	"	8
12-3	"	0	21-13	"	16	31-2	"	0	49-6	"	11
13-1	2-27	179	21-14	"	7	31-3	"	0	49-7	"	22
13-2	"	25	21-15	"	12	31-4	"	24	49-8	"	13
13-3	"	14	21-16	"	7	32-1	3-8	85	49-9	"	9
13-4	"	197	21-17	"	3	32-2	"	53			
13-5	2-27	10	22-1	3-4	0	34-1	3-8	238			
	2-28		22-2	"	0	34-2	"	18	243		4106
14-1	2-28	33	22-3	"	0	34-3	3-9	30			
14-2	"	4	23-1	3-4	0	34-4	"	34			
14-3	"	2	23-2	"	0	35-1	3-9	10			
15-1	2-28	0	23-3	"	0	35-2	"	0			
15-2	"	0	23-4	"	7	35-3	3-10	0			
15-3	"	0	23-5	"	9	39-1	3-10	0			
15-4	"	5	23-6	"	18	39-2	"	0			
16-1	2-28	0	23-7	"	12	39-3	"	0			
16-2	"	0	23-8	"	21	39-4	"	0			
16-3	"	0	23-9	"	12	39-5	"	0			
16-4	"	0	23-10	3-4	36	39-6	"	0			
16-5	"	0	23-11	3-5	6	39-7	"	0			
16-6	"	0	23-12	"	48	39-8	"	0			
16-7	"	0	23-13	"	44	39-9	3-10	0			
16-8	2-28	0	24-1	3-5	34	39-10	3-11	0			
16-9	3-1	0	24-2	"	0	39-11	"	0			
16-10	"	0	24-3	"	0	41-1	3-17	0			
16-11	"	0	25-1	3-5	141	41-2	"	0			
16-12	"	0	25-2	"	37						

10. ECOLOGICAL STUDIES ON IWASHI, JACK-MACKEREL,  
MACKEREL AND COMMON SQUIDS

I. UOTANI and S. OHARA

The aim of the present study is to secure ecological data on the distribution, behavior and feeding habits of diverse pelagic fish larvae in the surveyed area. Such basic information will be a most important contribution to the fishery biologic studies of the neritic-pelagic fishery resources of the Japanese and adjacent waters.

The materials treated here were obtained by the R/V Hakuho-Marui, Ocean Research Institute, University of Tokyo, during her cruise for biological studies of the larval stage of the Japanese eel conducted during the period from February 21 to March 27, 1973. In this survey, horizontal surface tows by larva-net and mid layer, deep layer oblique and stepwise hauls by ORI-net, IKMT-net and 4 m-net were made, totaling 243 tows at 39 stations. However, since at each station 10 minute and 20 minute tows of the larva-net were made consecutively, the 2 have been treated in this report as one combined unit and the total number of tows becomes 206.

It had been planned that larvae of sardine Sardinops melanosticta, roundherring Etrumeus micropus, anchovy Engraulis japonica, jack-mackerel Trachurus japonicus, and mackerel Scomber japonicus were to be counted by haul, but sardine, round herring and mackerel did not occur. Table 1 show the number of specimen of squid by genus (or partly by subfamily), octopods by family and fish by species. Almost all of the stations were positive for squid, collecting 1942 specimens in all. The majority of octopods, which totaled 87 specimens from 11 stations, belonged to family Argonautidae. Octopods were much fewer than squid in population numbers. Fig. 1 shows the ratio of squid by genus (partly by subfamily). The most dominant genus was Onychoteuthis (23.0%) followed by Abralia (18.4%). As is shown in Figure 2, two dominant genera are universally distributed throughout the whole surveyed area. 140 (7.2%) Rhynchoteuthion larvae were counted in all, but none of them seemed to be Todarodes pacificus.

Only 4 stations (10.3%) were positive for larvae of Engraulis japonica. The number of specimens attained (15196) were concentrated in Sts. 39, 41, 44 and 46 southwest of Formosa in the South China Sea (Table 2, Fig. 3). The size of many specimens was 8-10 mm in total length. This finding suggests that a considerable amount of spawning takes place in the South China Sea. It is believed that this population of anchovy is independent from that inhabiting the surrounding seas of Japan proper, but this assumption is inconclusive as the survey was done in the limited time and space. Only a single specimen of Trachurus japonicus (33.9 mm in

T. L. ) was obtained from St. 23-7 (  $23^{\circ}15.8'N.$ ,  $124^{\circ}36.7'E.$  ). This is a range extension (south  $3^{\circ}$  in latitude) from the southern limit hither to believed ( $26^{\circ}$  N by Fishery Agency 1972). No specimens of Sardinops melanosticta and Scomber japonicus were found. The negative result coincides with the previous report.

We are indebted to Dr. Takashi Okutani, Tokai Regional Fisheries and Laboratory, for the identification of cephalopod specimens and members of University of Kyushu and Kagoshima University for sorting the pelagic fish larvae.

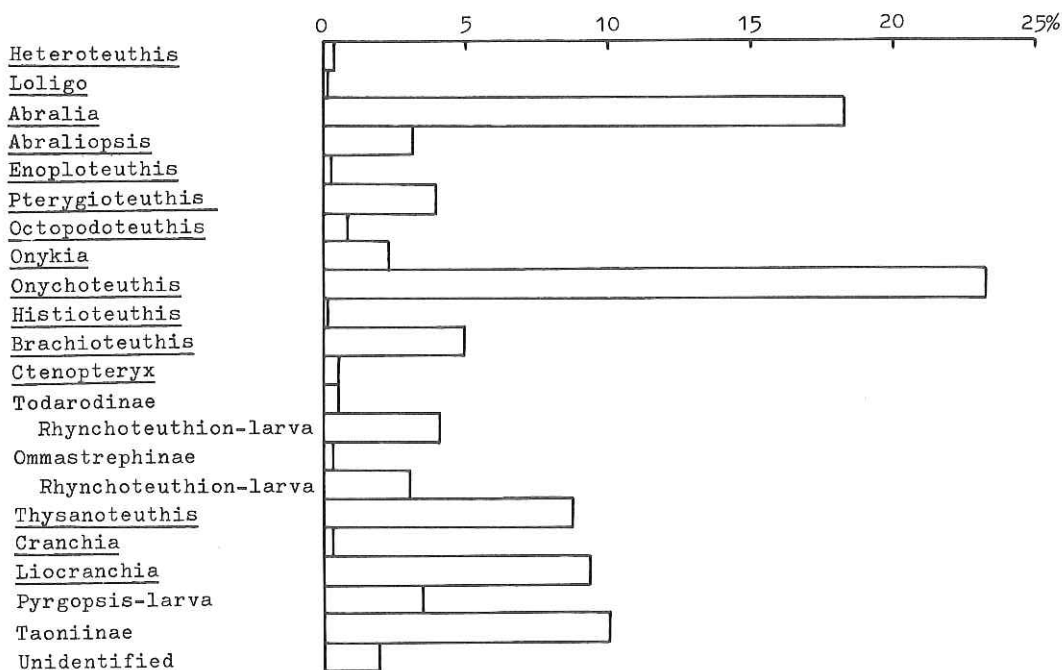


Fig.10-1. Percentage composition of squid by genus (partly by subfamily).



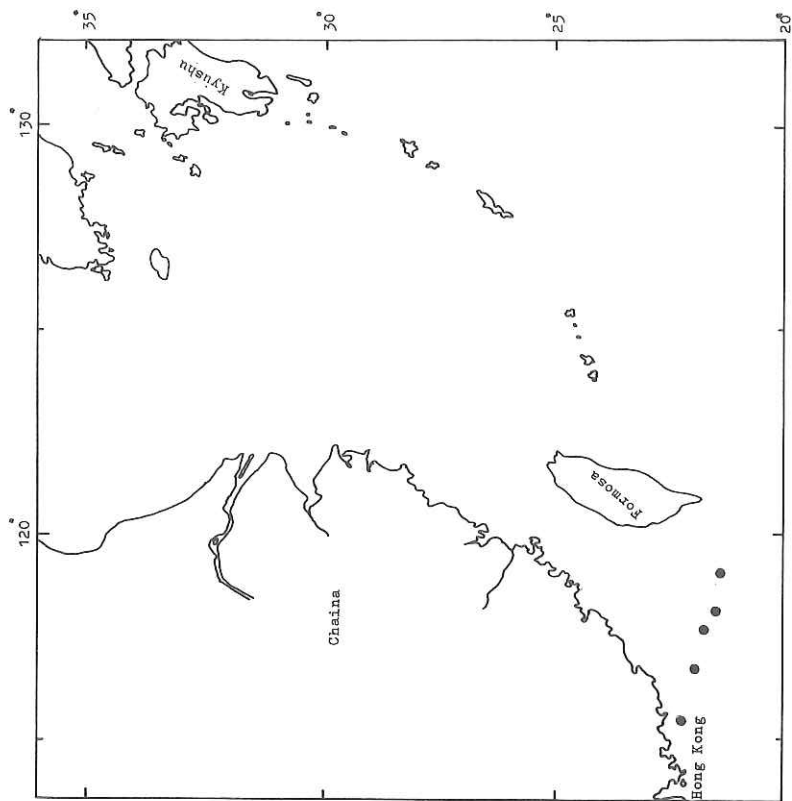


Fig.10-3. Distribution of *Engraulis japonica*.

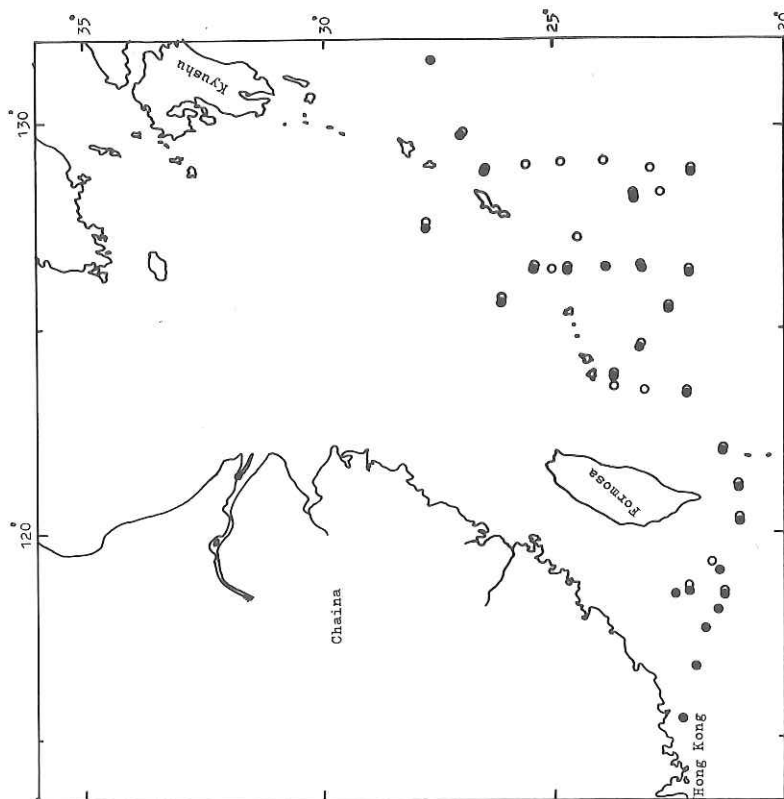


Fig.10-2 distribution of dominant two genera of squid.

- *Abrolia*
- *Onychoteuthis*

Table 10-1. Number of specimens of cephalopods by haul

Station (by haul)	2-1	2-2,3	3-2	3-3,4	4-1	5-1	6-2	6-4	6-5	6-6,7	7-1	7-2,3	8-1	9-1	9-2	10-1	10-2,3	10-4	11-1	11-2,3	12-1	12-2,3	13-1	14-1	14-2,3	15-1									
DECAPODA																																			
<u>Heteroteuthis</u>																																			
<u>Loligo</u>																																			
<u>Abrealia</u>	1		1															2																	
<u>Abraliopsis</u>					1														1																
<u>Enplototeuthis</u>																																			
<u>Pterygototeuthis</u>			1	1	1														6	2															
<u>Octopodoteuthis</u>																																			
<u>Onykia</u>																																			
<u>Onychoteuthis</u>		2	1								3	1	1	4	5	7			5	1															
<u>Histioteuthis</u>																																			
<u>Brachioteuthis</u>	2	1											1			4	2																		
<u>Ctenopteryx</u>													1	1																					
Todarodinae																																			
<u>Rhynchoteuthion-larva</u>																																			
<u>Ommastrephinae</u>																																			
<u>Rhynchoteuthion-larva</u>																																			
<u>Thysanoteuthis</u>																																			
<u>Cranchia</u>																																			
<u>Liocranchia</u>																																			
<u>Pyrgopsis-larva</u>																																			
<u>Taoniinae</u>																																			
<u>Unidentified</u>																																			
<u>Total</u>	7	5	2	2	0	27	10	2	8	2	4	3	4	8	9	14	4	4	35	15	2	8	1	2	32	3	8								
OCTOPODA																																			
<u>Argonautidae</u>																																			
<u>Octopodidae</u>																																			
<u>Total</u>																																			

Table shows only those hauls in which cephalopods were taken.















Table 10-1. Cont.

Station (by haul)	49-2,3	49-4	49-5	49-6	49-7	49-8	49-9	Total	%
DECAPODA									
<u>Heteroteuthis</u>								5	0.3
<u>Loligo</u>								2	0.1
<u>Abralia</u>	1	1	1		13			357	18.4
<u>Abraliopsis</u>			1	6				64	3.3
<u>Enplototeuthis</u>			1					4	0.2
<u>Pterygioteuthis</u>								75	3.9
<u>Octopodoteuthis</u>	1							16	0.8
<u>Onykia</u>								42	2.2
<u>Onychoteuthis</u>	2	7	10	1				447	23.0
<u>Histioteuthis</u>								2	0.1
<u>Brachioteuthis</u>								95	4.9
<u>Ctenopteryx</u>								9	0.5
<u>Todarodinae</u>								9	0.5
<u>Rhynchoteuthion-larva</u>					2			77	4.0
<u>Ommastrephinae</u>								6	0.3
<u>Rhynchoteuthion-larva</u>								63	3.2
<u>Thysanoteuthis</u>	1				2	1		167	8.6
<u>Cranchia</u>								28	1.4
<u>Liocranchia</u>	1	1	2	1	2	2		178	9.2
<u>Pyrgopsis-larva</u>	1	1						65	3.3
<u>Taoniinae</u>			1			2		193	9.9
<u>Unidentified</u>	1			1				38	1.9
<u>Total</u>	4	12	16	4	1	10	20	1942	
OCTOPODA									
<u>Argonautidae</u>								59	67.8
<u>Octopodidae</u>								28	32.2
<u>Total</u>								87	

Table 10-2. Number of anchovies and jack-mackerel by haul

Station (by haul)	23-7	39-6	41-1	41-2,3	41-4	44-1	44-2,3	44-4	44-5	44-12	44-13	44-14	44-15	44-16	46-2,3	46-4	46-5	Total
<u>E. japonica</u>	0	2	84	3552	1745	13	5	4	2	2	767	4629	413	332	2043	357	1246	15196
<u>T. japonicus</u>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table shows only those hauls in which fish of larvae were taken.

11. UNDERWATER PHOTOGRAPHY OF BENTHIC ANIMALS OFF  
RYUKYU ISLANDS AND IN THE SOUTH CHINA SEA

G. YAMAMOTO, M. HORIKOSHI, H. HASUMOTO,  
H. MUKAI and K. AIOI

Underwater photographs of benthic animals were taken at 4 stations in the deep-sea system off Ryukyu Islands and at 2 stations on the continental shelf in the South China Sea (Table 1) by a deep-sea camera (EG & G : Model 210A).

Swimming behavior of a macrourid fish was observed against a fixed object (sea-urchins) in a series of 4 successive photographs. Several sorts of peculiar "lebensspur" were photographed at different stations.

12. STUDIES ON BENTHIC FAUNAE IN THE DEEP-SEA SYSTEM  
OFF RYUKYU ISLANDS AND ON THE CONTINENTAL SHELF  
IN THE NORTHERNMOST PART OF THE SOUTH CHINA SEA

G. YAMAMOTO, M. HORIKOSHI, H. MUKAI and K. AIOI

Macro- and megalobenthos were collected by a beam-trawl of Agassiz-Sigsbee type having a 3 m span. The number of the trawling stations established in this cruise, KH-73-2, were two on the deep-sea shelf of bathyal depths (900, 1700 m), two in the abyssal depths (3450, 4200 m) in the same waters, and six on and around the continental shelf (55-420 m) in the northernmost part of the South China Sea (Table 1).

The bathyal fauna on the deep-shelf off the Ryukyu Islands was found to be more or less different from the fauna of similar depths off north-eastern Honshu, the Japanese main island. Common forms representing the latter fauna such as Ctenodiscus crispatus, Colossendeis colossea and Ascorhynchus japonicus, (Horikoshi; 1971: La Mer, 9 (1):46-53) were not found at these stations off the Ryukyu Islands. Also the biomass seemed to be somewhat lower in this locality.

At two stations on the continental shelf off Hongkong (77, 95 m), a quantitative sampling of macrobenthos was also made (Table 2), with a pair of Smith-McIntyre's Spring-loaded Grabs, which was set in an iron frame (ORI Double Samplers Frame: Horikoshi; 1968: Jour. Mar. Geol., 4 (1):40-45). The sediments sampled were washed through a set of sieves of 2.0, 1.0 and 0.5 mm meshes, and the washed samples were fixed in formalin neutralized with Hexamin (hexamethylene-tetramin).

St. 4\*\* PORIFERA: Hyalonema sieboldi-type, 4 colonies; Semperella schultzei ?, many; gen. spp., many. \*\* COELENTELATA : Actiniaria 3 spp., 3; Madreporaria (solitary coral), 2 spp., 12; Alcyonacea, 1; Gorgonacea, 3 spp. (including Keratois squarrosa), 7. \*\*ANNELIDA: Polychaeta 4 spp., 5. \*\*MOLLUSCA : Gastropoda 1 sp., 4; Cephalopoda 1 sp., 1. \*\*CRUSTACEA : Macrura 11 spp., 74; Anomura 4 spp., 15; Cirripedia 2 spp. (on Keratois squarrosa), 15. \*\* ECHINODERMATA: Asteroidea, Brisinga sp., 2; Echinoidea 5 spp., 10; Ophiuroidea, Asteronyx loveni (on gorgonian), 6; other ophiurids 3 spp., 33; Holothuroidea 4 spp., 6; Crinoidea, 4. \*\* VERTEBRATA (PISCES) : Ijimaia sp., 4; Alepocephalus sp., 1; Coelorhynchus sp., 1; Hymenocephalus sp., 1; Malthopsis sp., 5; other pisces 2 spp., 3.

St. 7 \*\* CRUSTACEA : Mysidacea, Gnathopausia ingens, 1; Macrura, Penaeidae, 2. \*\* ECHINODERMATA : Pseudostichopus trachus ?, 1.

- St. 18 \*\* PORIFERA : Semperella schultzei ?, 1; Hyalonema sp., 1; other hexactinellid sponges 2 spp., 2; Calcarea, 1. \*\* COELENTELATA : Hydrozoa 2 spp., many; Scyphozoa 2 spp., 6. \*\* MOLLUSCA : Arcidae 1 sp., 10. \*\* CRUSTACEA : Isopoda, Arcturus sp., 11; Cirripedia, 1; Euphausiacea, Thysanopoda cornuta, 1; Anomura, 1; Macrura, Glyphocrangon sp., 2; other shrimps 2 spp., 2. \*\* ECHINODERMATA : Crinoidea, 1; Echinoidea 2 spp., 3; Asteroidea, Brisingidae 1 sp., 3; Ophiuroidea 6 spp., 14; Holothuroidea, 1. \*\* VERTEBRATA (PISCES) : Synaphobranchus affinis, 1.
- St. 24 \*\* COELENTELATA : Actiniaria 2 spp., 18; Hydrozoa 1 sp., 8. \*\* ANNELIDA : Polychaeta 2 spp., 7. \*\* MOLLUSCA : Gastropoda, Orectospira sp., 1; Pelecypoda, Bentharca spp., 7; Tharcia ? spp., 4; Scaphopoda, Cadurus sp., 1. \*\* CRUSTACEA : Cumacea 1 sp., 1; Anomura, Galathea sp., 1; other anomuran sp., 1; Macrura, Eryonidae 1 sp., 1; other shrimps 2 spp., 2. \*\* ECHINODERMATA : Ophiuroidea, Ophiolepididae 4 spp., 31; Echinoidea 2 spp., 7. \*\* VERTEBRATA (PISCES) : Bathysaurus mollis, 1.
- St. 36 \*\* COELENTELATA : Pennatulacea, 1; Actiniaria, many; Zoantaria, Epizoanthus ramosus (symbiosis with Paguristes balanophilus), many. \*\* ANNELIDA : Polychaeta, 5. \*\* MOLLUSCA : Gastropoda, Niotha clothrata, 1; Pleurobranchaea novaezealandiae, 1; Cephalopoda, Sepia sp., 3. \*\* CRUSTACEA : Macrura 5 spp., 12; Anomura, Paguristes balanophilus (symbiosis with Epizoanthus ramosus), 25; other anomuran 2 spp., 15; Brachyura, Xanthidae 2 spp., 7; Calappidae 1 sp., 10; Latreillidae 1 sp., 1. \*\* ECHINODERMATA : Ophiuroidea, Gorgonocephalus sp., 1; other ophiurid 2 spp., 6; Asteroidea, Stellaster equestris, 82; Astropectinidae 1 sp., 1. \*\* VERTEBRATA (PISCES) : Lophiidae 1 sp., 1; Bothidae 3 spp., 6; Bregmaceros japonicus, 1; Triglidae 1 sp., 1; Tetraodonidae 1 sp., 3; Embolichthys mitsukurii, 1; Apogon lineatus, 2; Trachinocephalus myops, 25.
- St. 41 \*\* PORIFERA : Demospongia, 2. \*\* COELENTELATA : Dentitheca ? sp., 4; Veretillidae 1 sp., 1. \*\* ANNELIDA : Polychaeta 1 sp., 9. \*\* BRACHIOPODA : 1 sp., 1. \*\* MOLLUSCA : Gastropoda, Ficus subintermedia, 3; Gyrineum elegans, 1; Nassariidae 1 sp., 1; Naticidae 1 sp., 1; Mitridae (Pusia ? sp.), 1; Turridae (Lophiotoma ? sp.), 1; Terebridae 1 sp., 1; Doridae 1 sp., 1; Scaphopoda, Dentalium octangulatum, 1; Pelecypoda, Tellinidae 1 sp., 1; Veneridae (Pitar ? sp.), 1; Cephalopoda, Sepia sp., 2, egg masses, many. \*\* CRUSTACEA : Brachyura, Liagore rubromaculata, 2; Lyreidus integrus, 2; Leucosiidae 1 sp., 1; Portunus sp., 27; Thalamita sp., 1; Majidae 1 sp., 2; Goneplacidae 2 spp., 4; Macrura, Penaeidae 3 spp., 11; Scyllarus sp., 16; Alpheus sp., 4; Hippolytidae 1 sp., 3; Stomatopoda, 3. \*\* ECHINODERMATA : Echinoidea, Laganum depressum, 64; Asteroidea, Craspidaster hesperus, 1.

- \*\* VERTEBRATA (PISCES) : Halieuthea sp. , 1; Lophiomus setigerus, 2; Aesopia cornuta, 1; Cynoglossus robustus ? , 6; Bothidae 2 spp. , 6; Pterygotrigla ryukyuensis, 2; Scorpaenidae 1 sp. , 4; Stephanolepis japonicus ? , 1; Pomacentridae 1 sp. , 2; Uranoscopidae 1 sp. , 1; Callionymidae, 1; Raja sp. , 1; other fishes 5 spp. , 8.
- St. 43-1 \*\* COELENTELATA : Dendronephthya habereri? , 1; Virgulariidae 1 sp. , 3; Flabellum distinctum, 5; Plumularia? s spp. , 7; Thouarella ? sp. , 5.
- \*\* CRUSTACEA : Brachyura, Portunidae 1 sp. , 16; Leucosiidae 1 sp. , 1; Majidae 1 sp. , 3; Latreillia valida, 2; other Latreillidae 1 sp. , 1; Xanthidae 1 sp. , 5; Anomura, Galathea sp. , 5; other 1 sp. , 18; Macrura, Penaeidae 1 sp. , 27; Crangon sp. , 90; Hippolytidae 3 spp. , 5; Ibacus ciliatus, 1; Mysidacea 1 sp. , 8.
- \*\* ECHINODERMATA : Asteroidea, Luidia sp. , 2; Ophiuroidea 1 sp. , 1; Crinoidea 1 sp. , 1; \*\* ASCIDIA : 1 sp. , 1. \*\* VERTEBRATA (PISCES) : Rajidae, 4; Antigonia rubescens, 1; Bothidae 2 spp. , 15; Pterygotrigla spp. , 4; Tetraodontidae 2 spp. , 3; Scorpaenidae 1 sp. , 2; Neopercis sexfasciata ? , 2; Cyclopteridae 1 sp. , 1; Bembrops sp. , 4; Synodus sp. , 1; Champsodon guentheri? , 1; other 3 spp. , 4.
- St. 43-2 \*\* COELENTELATA : Actiniaria, 3; Antipathidae, 6; Melitodidae, 5; Plumularia ? sp. , 1. \*\* MOLLUSCA : Ethminolia stearnsi? , 5; Biplex perca, 1; Epitoniidae 1 sp. , 1. \*\* CRUSTACEA : Brachyura, Portunus sp. , 18; Majidae 2 spp. , 2; Anomura, Galathea sp. , 117; other spp. , 12; Macrura, Penaeidae 2 spp. , 11; Hippolytidae 2 spp. , 2; Palinuridae 1 sp. , 2; Ibacus ciliatus, 1; other macruran spp. , 7. \*\* VERTEBRATA (PISCES) : Malthopsis annulifera, 5; Ventrifossa ? sp. , 13; Bothidae 1 sp. , 1; Peristedion nierstraszi, 1; Antigonia rubescens, 1; Ateleopus japonicus, 1; Hoblichthys sp. , 7; Bembrops sp. , 3; Malakichthys wakiyai ? , 12; Scopaenidae 1 sp. , 1; Congridae 1 sp. , 2; Argentinidae 1 sp. , 1; Chlorophthalmidae 2 spp. , 10; other fishes.
- St. 44-1 \*\* COELENTELATA : Plumularia ? sp. , 1; Virgulariidae 1 sp. , 3.
- \*\* ANNELIDA : Polychaeta, 1. \*\* MOLLUSCA : Ethminolia stearnsi? , 1.
- \*\* CRUSTACEA : Macrura, Parahaliporus sibogae ? , 19; other penaeid sp. , 24; Heterocarpus sibogae, 13; Parapandalus spinipes, 14; Plesionika martia ? , 74; Processidae 1 sp. , 13; other Caridean shrimps 4 spp. , 4; Anomura, Galathea sp. , 11; other anomuran sp. , 1; Brachyura, Majidae 1 sp. , 1. \*\* VERTEBRATA (PISCES) : Eptatretus burgeri, 2; Caunax fimbriatus, 1; Malthopsis annulifera, 1; Cyclopteridae 1 sp. , 1; Tydemania navigatoris, 1; Symphurus strictus ? , 13; Platycephalidae 1 sp. , 2; Coelorhynchus sp. , 6; Lionurus sp. , 2; Malacocephalus ? sp. , 1; Hymenocephalus sp. , 17; Bregmaceros japonicus, 3; Polyipnus tridenlifer, 6; P. sterope, 1; P. aguavitus, 1.

St. 44-2 \*\* PORIFERA : Hexactinellida spp. , 8. \*\* COELENTELATA : Parazoanthus gracilis ? , ca. 50; Actiniaria 1 sp. , 1; Alcyonaria 1 sp. , 4; Antipathidae 2 spp. , 227; Teleostacea 2 spp. , 3; Callogorgia flabellum ? , 10; Melitodiidae 2 spp. , 6; \*\* NEMERTINA , 2. \*\* ANNELIDA : Polychaeta , 3. \*\* BRYOZOA : 1. \*\* MOLLUSCA : Gastropoda , Ovlidae 1 sp. , 1; Pelecypoda , Pectinidae (Palliolum ?) , 1; Cephalopoda , 1. \*\* CRUSTACEA : Brachyura , Portunidae , 2; Majidae , 1; Xanthidae , 1; Anomura , Galathea sp. , 20; other anomuran sp. , 2; Macrura , Heterocarpus sibogae , 21; Plesionika martia ? , 154; Parapandalus spinipes , 8; Parahaliporus sibogae ? , 8; other shrimps 5 spp. , 8. \*\* ECHINODERMATA : Ophiuroidea , Asteroschema glutinosum ? , 1; other sp. , 4. \*\* VERTEBRATA (PISCES) : Raja sp. , 1; Malthopsis annulifera , 1; Coelorhynchus sp. , 2; Cetonurus robustus ? , 1, Hymenocephalus sp. , 23; Lionurus ? sp. , 5; other Macrourina sp. , 2; Cynoglossidae 1 sp. , 5; Triglidae 1 sp. , 1; Paratriacanthodes retrospinis ? , 1; Brotulidae 1 sp. , 1; Congridae 1 sp. , 1; Scorpaenidae 1 sp. , 1; Polyipnus spinosus , 4; P. sp. , 1; Diaphus sagamiensis , 3; D. latus , 8; Polymetme illustris , 1.

Table 12 - 1.

Station	Position	Depth	Date
4	27°06.8'N 128°41.9'E 27°06.7'N 128°41.8'E	870 - 945 m	Feb. 24, '73 04 : 28 05 : 30
7	24°50.2'N 129°11.0'E 24°51.0'N 129°10.0'E	4180 - 4355 m	Feb. 25, '73 21 : 40 23 : 13
18	24°43.4'N 126°28.0'E 24°47.0'N 126°26.3'E	1675 - 1710 m	March 1, '73 16 : 38 18 : 45
24	23°41.3'N 123°45.2'E 23°42.3'N 123°45.8'E	3436 - 3452 m	March 5, '73 14 : 23 15 : 33
36	22°08.3'N 117°44.6'E	80 - 80 m	March 10, '73 06 : 54 08 : 00
41	22°15.3'N 115°28.2'E 22°15.7'N 115°28.9'E	55 - 55 m	March 18, '73 00 : 50 01 : 50
43-1	21°48.8'N 117°00.0'E 21°50.1'N 117°01.6'E	145 - 150 m	March 18, '73 12 : 12 13 : 12
43-2	21°45.8'N 117°21.1'E 21°46.9'N 117°23.4'E	282 - 290 m	March 18, '73 15 : 50 16 : 50
44-1	21°41.2'N 117°31.1'E 21°42.7'N 117°33.4'E	415 - 437 m	March 19, '73 05 : 08 06 : 08
44-2	21°42.0'N 117°31.4'E 21°42.4'N 117°33.1'E	412 - 430 m	March 19, '73 13 : 49 14 : 53

Table 12 - 2

Station	Position	Depth	Date
39	21°55.0'N 116°35.0'E	95 m	March 11, '73 02 : 10
40	22°04.0'N 115°48.9'N	77 m	March 11, '73 06 : 26

### 13. STUDY ON THE ECHO PATTERN OF INDIVIDUAL FISH BY PATTERN ANALYSIS

T. ISHII and H. ABE

#### (1) Collection of the echo signals (F-observation).

The records of the fish detector (frequency : 28 kHz) were obtained at one station (St. F-1). These recording were carried out continuously at three different ship speeds (4, 6, 8 kt) and the echo signal was recorded in the magnetic tape at the each speed for 30 minutes by the data recorder (TEAC Co. R-351F).

#### (2) Design of the echo pattern mask by the automatic mask design system.

For counting the echo pattern of a large sized individual automatically, it is necessary to design the standard pattern, which is called the mask due to this mode of comparison.

In the previous cruise (KH-72-1), three programs were developed and completed for three functions as follows :

- i) extracting the concurrence of element (echo pulse), called set or subset, from the echo data and transferring this information to magnetic tape,
- ii) print-out of data from MT stored by the program mentioned above,
- iii) print-out of the character table for the data of subset.

In this cruise, new programs were completed for designing the mask from the group of set and subset. New programs were as follows :

Program 12 : From the concurrence of element (set or subset), recorded on MT, the mask is designed automatically in each depth range set beforehand.

#### (3) Development of the total pattern counting system, including the automatic designing process of the standard mask.

For the completion of the mask designing program, the soft wear for the total echo pattern counting system, including the process which designs the mask, was developed and that system consists of four blocks.

Program 13 : The transmission of the echo data from paper tape to the magnetic drum.

Program 14 : Extraction of set and subset from the echo data. Function of this program is equivalent to that of Program 9 which was completed by the previous cruise (KH-72-1).

Program 15 : Design of the standard mask.

Program 16 : Recognition the echo pattern by the method of comparison echo data with the mask, and counting the echo pattern in each depth range as set beforehand.

Besides those programs, some programs were provided for the setting of



## 14. STD OBSERVATION AND AN IMPROVEMENT OF STD PROGRAM

H. HASUMOTO, T. ISHII and W. SAKAMOTO

STD (HYTECH MODEL 9006) observations were carried out at two stations to take data of vertical distributions of salinity and temperature as follows.

Station No.	Date	Time	Lat. (N)	Long. (E)	Depth (m)
46	Mar. 20	13:20	21°34.0'	119°01.1'	800
49	Mar. 23	11:59	17°54.2'	127°36.0'	800

The new pressure sensor (MODEL 4006 ; depth range : 0-1500 m) was successfully used by improvement of the computer program of STD real time operation in addition to present sensor (0-6000 m).

The measurement of pressure by the new sensor was more accurate than that of sensor (MODEL 4006 ; depth range : 0-6000 m) used up to the present. initial conditions and parameters and the connection of main programs.

Testing this system on some examples indicated that there were a few problems to be solved. Further work on the system is now in progress.

## 15. PHYSICAL STUDIES OF THE BOTTOM BOUNDARY LAYER

S. OGUCHI, M. WATANABE, W. SAKAMOTO and H. HASUMOTO

A few physical experimental works on bottom boundary layers were carried out at Stas. 7,46 and 49, where the depths of water were about 4500, 2700 and 1200 m, respectively.

The purposes and outlines of these works are as follows.

1. Deep current measurements by successive stereoscopic photographs of released dye patches.

Purposes of this experiment are 1) to study micro structures of the bottom boundary current, 2) to clarify transfer processes of materials in the bottom layer and 3) to present preliminary data on measurements of quantities related to physical oceanography on benthic boundary layer.

2. Recording test of a multi-channel digital cassette recorder on deep sea bottom.

Signals obtained from thermistors were used as inputs.

3. In situ examinations of glass housings for deep sea measurements.

The observation stations were chosen by taking into account that the depths and flatnesses of the bottoms were similar to those of an abyssal plain and that sea conditions were expected to be calm.

Instrumentations are shown in Fig. 1 and 2 as schematic block-diagrams. Each experiment was continued for a period from one to several hours on the bottom. Mooring systems used in these works are illustrated in Fig. 3. The log records of these operations are shown in Tables following.

The following are results of these works.

1. On the deep sea bottom, a series of stereoscopic photographs was obtained. A pair of these photographs is shown as an example.
2. The digital recording was performed on the bottom.
3. As to the in situ examinations of glass housings, a few damages of the glass balls were found which had not been experienced in the previous laboratory tests using a high pressure tank.

These studies are included in the deep sea project which has been carried out under the charge of Toshihiko Teramoto, Prof. of Physical Oceanography, The Ocean Research Institute.

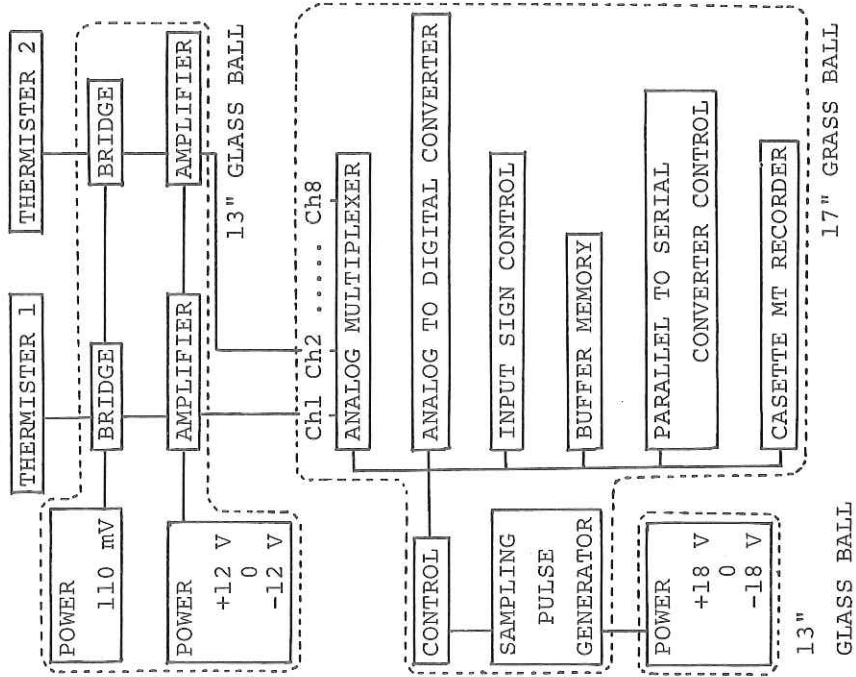


Fig. 15-2 The system of temperature measurement and recording.

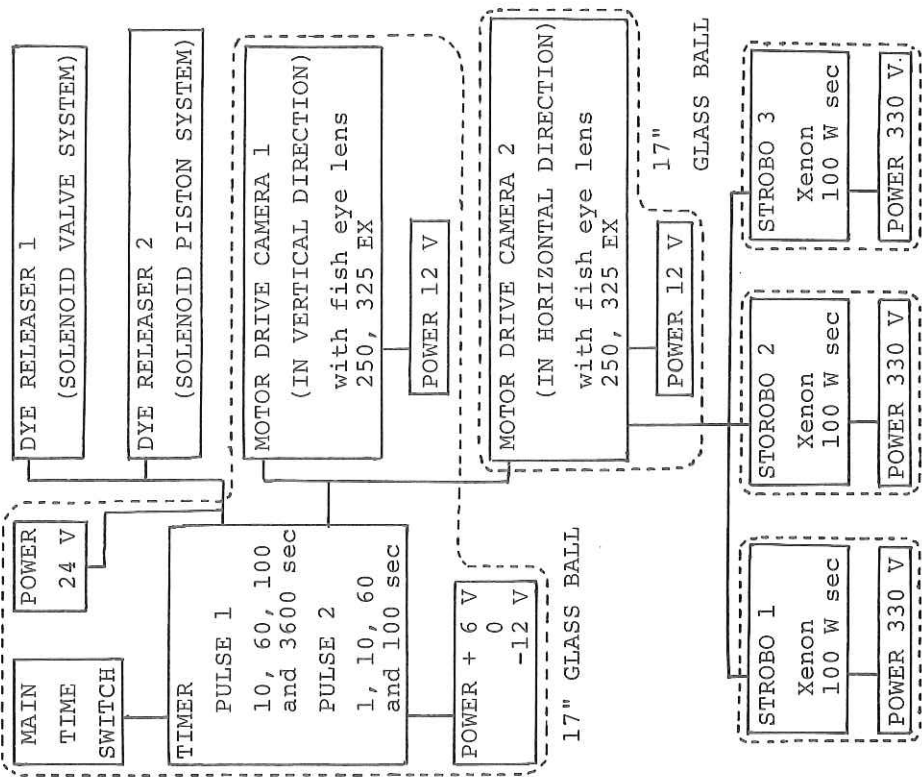


Fig. 15-1 Block diagram and specification of the micro scale current meter.

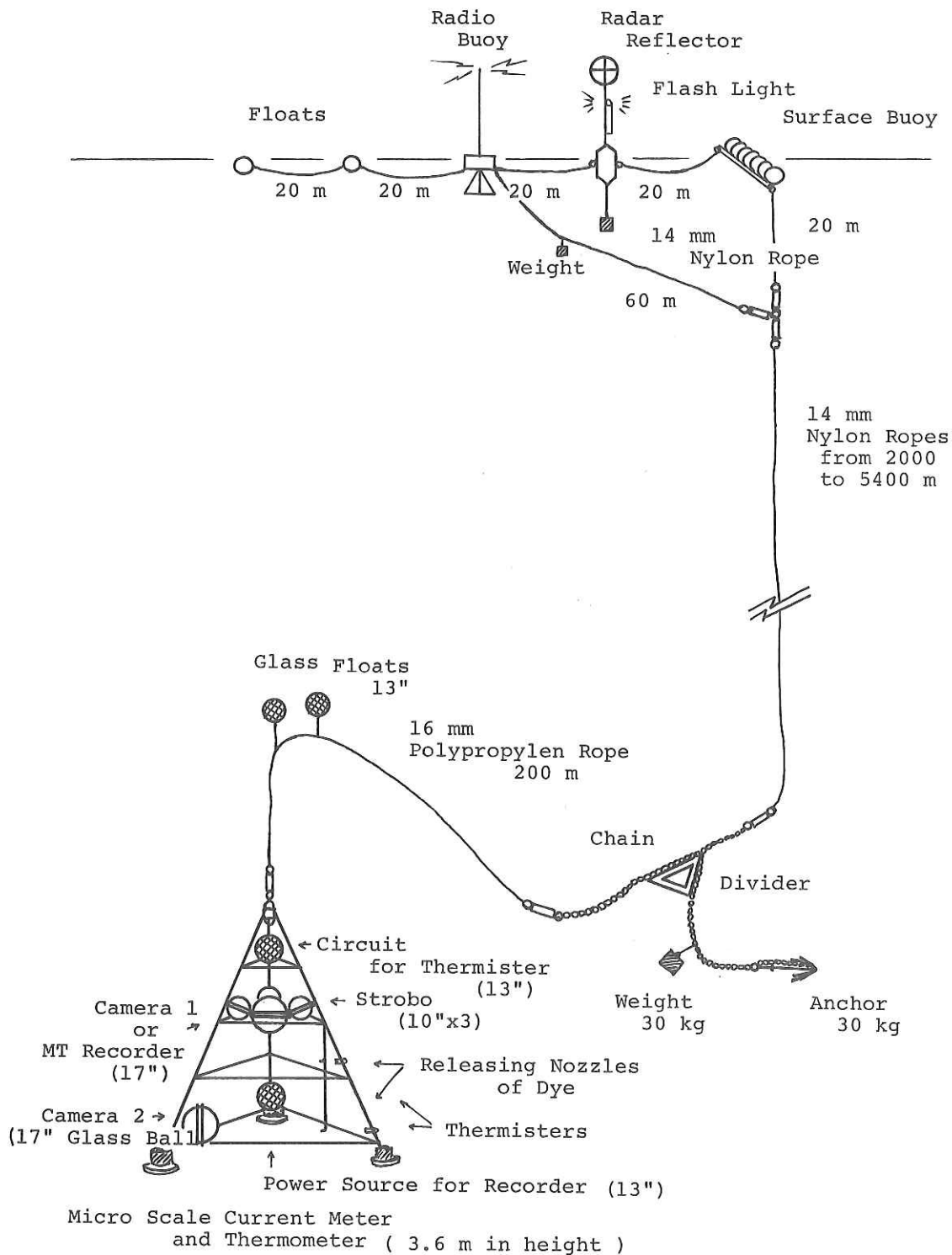


Fig. 15-3 Mooring arrays

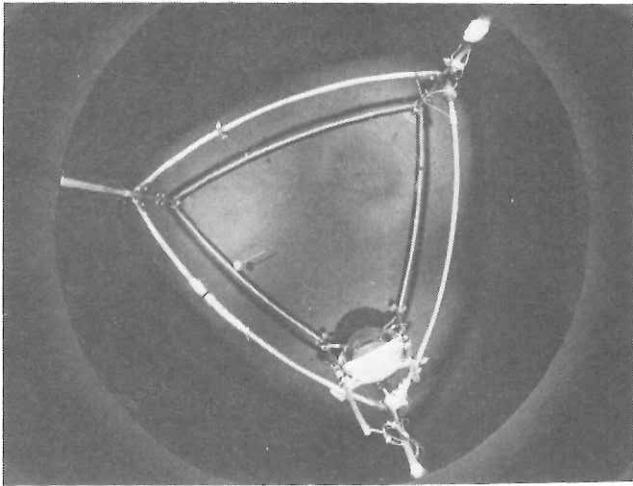


Photo. 1

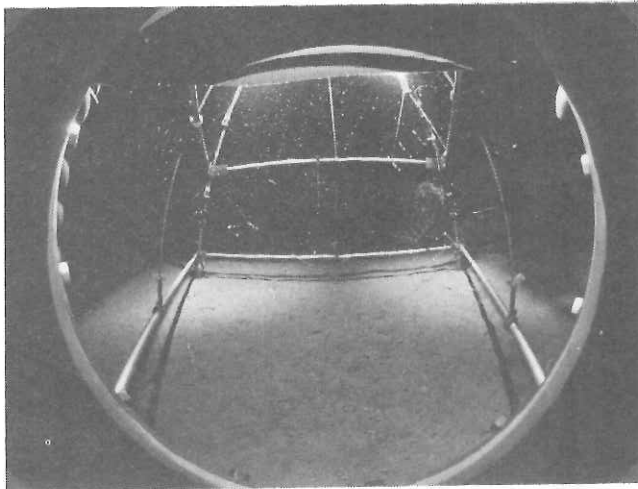


Photo. 2

Photo. 1 and 2 An example of stereoscopic photograph  
in Sta. 46 Photo. 1 was shot from above vertically  
through a fisheye lens, Photo. 2 was taken in horizontal  
direction.

## LOG RECORDS

Date Feb. 25      Station 7  
Position 24°50.0'N 129°12.0'E      Water depth 4420 m  
Purposes of experiment 1 and 3

<u>Time</u>	<u>Operation</u>
9 : 35	Launch
11 : 00	Onto bottom
11 : 53	Surface buoy off from vessel
15 : 09	Catch surface buoy
15 : 40	Off from bottom
17 : 22	Finish

Conditions

	Deployment	Recovery
Ship bow azimuth	Var.	Var.
Ship speed	Var.	Var.
Wind direction	NE (Left 135°)	SE (Left 135°)
Wind speed	5.0 m/s	7.5 m/s
Wind waves	3	4
Swells	4	4
Weather	Partly cloudy	

Remarks

1. Water penetration occurred in one of five glass spheres which were used in this operation.
2. A part of the main rope was tangled.
3. At a few joints of the system near the sea surface, connection tools such as swivels, shackles and thimbles were damaged but the instruments were recovered.
4. The descent speed seems to have been too fast.

Date Mar. 20      Station 46  
Position 21°33.4'N 119°01.7'E      Water depth 2673 m  
Purposes of experiment 1 and 3

<u>Time</u>	<u>Operation</u>
10 : 25	Launch
12 : 05	Onto bottom
12 : 50	Surface buoy off from vessel
15 : 15	Catch surface buoy
16 : 02	Off from bottom
17 : 19	Finish

Conditions

	Deployment	Recovery
Ship bow azimuth	Var.	Var. (N 7°)
Ship speed	Var.	Var. ( -0.5 kt )
Wind direction	ESE (180°)	SE (Right 120°)
Wind speed	7.0 m/s	9.0 m/s
Wind waves	5	5
Swells	4	4
Weather	Blue sky	Blue sky - partly cloudy

Remark

All experimental conditions were optimum and the experiments were successful.

Date Mar. 23      Station 49

Position 27°53.4'N 127°35.4'E      Water depth 1189 m

Purposes of experiment 2 and a part of 1

<u>Time</u>	<u>Operation</u>
10 : 40	Launch
11 : 11	Onto bottom
-----	Surface buoy off from vessel
	STD
13 : 25	Catch surface buoy
13 : 55	Off from bottom
14 : 35	Finish

Conditions

	Deployment	Recovery
Ship bow azimuth	Var.	Var. (N 58°)
Ship speed	Var.	Var. ( -1.5 kt )
Wind direction	S (Right 135°)	SW (Right 135°)
Wind speed	8.0 m/s	10.0 m/s
Wind waves	3	4
Swells	3	3
Weather	Overcast	Rain

Remarks

1. Bottom condition was rough but the instruments were recovered safely.
2. The input test of thermister signals to the digital recorder was made successfully on the bottom.

Appendix - 1 KH - 73 - 2 B. T. Observation (1)

St. No.	Date & Time	Lat	Long	Depth (m)											Max		SLD			
				0	10	20	30	50	75	100	125	150	200	250	D	T				
	1973																			
2	2-22 23:30	27°42.4'	131°26.4'	19.5	19.6	19.6	19.5	19.5	19.4	19.3	19.3	19.3	19.3	19.3	19.3	17.6	16.8	255	16.7	150
3	2-23 08:17	27°00.5'	129°50.5'	20.7	20.7	20.7	20.8	20.8	20.8	20.6	20.5	20.5	20.2	20.2	18.6	17.5	261	17.3	90	
3-2	2-23 19:05	27°02.0'	129°41.7'	20.8	20.8	20.8	20.8	20.8	20.7	20.6	20.4	20.4	19.7	18.5	16.6	261	16.2	100		
4	2-24 01:09	27°10.0	128°40.5'	21.1	21.1	21.1	21.1	21.1	21.1	21.1	20.9	20.9	20.4	18.8	17.7	272	17.1	100		
6	2-24 14:38	25°45.4'	129°01.2'	22.2	22.4	22.4	22.2	22.2	22.2	22.1	21.9	21.9	21.9	20.4	18.7	262	18.5	70		
6-5	2-24 18:45	25°38.6'	129°03.6'	21.8	21.8	21.8	21.8	21.9	22.0	21.9	21.9	21.9	21.9	20.0	19.0	270	18.8	150		
7	2-25 00:17	24°51.4'	129°13.6'	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	20.1	18.7	250	18.7	150		
7-1	2-26 00:28	24°51.9'	129°09.1'	21.7	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	20.4	18.9	260	18.8	170		
8	2-26 06:12	25°59.2'	129°06.5'	21.4	21.5	21.5	21.6	21.6	21.5	20.9	20.7	20.7	20.1	19.0	18.0	268	17.6	60		
9	2-26 13:39	22°55.4'	128°58.5'	23.9	23.8	23.7	23.6	23.1	22.6	22.4	22.2	21.7	19.6	17.6	16.2	270	16.2	30		
10	2-26 22:15	22°00.5'	128°49.6'	23.8	23.8	23.7	23.6	22.9	22.1	21.6	20.5	18.2	17.5	17.0	16.8	261	16.8	20		
11	2-27 09:12	22°45.7'	128°19.5'	23.7	23.8	23.8	23.9	24.0	23.2	23.0	22.2	21.1	18.6	17.5	17.3	260	17.3	52		
12	2-27 15:30	23°23.8'	128°18.0'	23.1	23.1	22.6	22.0	22.0	21.8	21.6	21.4	20.8	18.6	17.4	17.1	260	17.1	10		
13	2-27 20:35	23°54.3'	127°35.3'	22.5	22.3	21.9	21.9	21.8	21.7	21.4	21.3	21.2	19.6	18.0	17.7	260	17.7	12		
14	2-28 07:32	24°34.0'	127°15.4'	23.6	23.6	23.6	23.6	23.5	22.6	22.1	21.9	21.8	19.6	18.0	17.9	251	17.9	52		
15	2-28 10:23	24°59.8'	126°51.8'	22.4	22.4	22.0	22.0	21.9	21.8	21.6	21.2	20.1	18.4	17.4	17.2	270	17.2	85		
16	2-28 16:57	25°32.0'	126°30.9'	22.6	22.6	22.5	22.5	22.4	22.3	22.2	21.8	20.9	19.6	17.6	17.4	260	17.4	110		
17	3-1 08:02	25°09.8'	126°30.3'	22.6	22.6	22.6	22.6	22.5	22.4	21.8	21.7	21.5	19.5	17.6	17.6	250	17.6	80		
18	3-1 19:28	24°47.3'	126°26.3'	23.2	23.2	23.2	23.2	23.1	22.9	22.8	21.4	20.0	18.4	17.4	17.2	266	17.2	100		
19	3-2 08:31	23°58.5'	126°29.3'	23.2	23.2	23.2	23.2	23.2	22.9	22.4	21.7	20.8	18.6	17.5	17.4	268	17.4	58		
20	3-2 16:57	23°09.0'	126°30.2'	23.8	23.8	23.8	23.8	23.5	22.8	21.6	20.5	19.8	18.1	16.8	16.7	265	16.7	34		
21	3-3 13:47	22°00.5'	126°31.0'	24.6	24.6	24.6	24.4	24.2	23.6	22.6	21.6	20.6	18.0	17.1	16.9	264	16.9	20		
21-1	3-3 19:33	22°10.4'	126°14.7'	24.2	24.2	24.2	24.2	24.2	23.8	22.7	21.3	20.0	17.3	17.0	16.9	255	16.9	50		
22	3-4 11:02	22°34.6'	125°32.0'	-	-	-	-	-	-	23.0	21.4	19.6	17.8	16.6	16.4	264	16.4	-		
23	3-4 18:13	23°09.7'	124°34.9'	24.9	24.8	24.8	24.8	24.4	23.7	23.4	22.0	20.7	18.7	17.4	17.4	275	16.4	48		
24	3-5 17:40	23°43.6'	123°46.9'	23.6	23.6	23.6	23.6	23.6	23.6	22.8	22.3	20.8	18.6	16.8	16.6	267	16.6	80		
25	3-5 21:47	23°46.5'	123°27.2'	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.4	22.1	19.1	18.2	18.1	260	18.1	90		



## Appendix - 1 KH - 73 - 2 B. T. Observation (2)

St. No.	Date & Time	Lat	Long	Depth (m)												Max D	Max T	STD	
				0	10	20	30	50	75	100	125	150	200	250					
26	3-6 08:22	23°03.2'	123°26.3'	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	262	18.1	130
27	3-6 22:20	21°52.7'	123°01.4'	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.2	23.2	22.8	22.9	19.6	18.5	250	18.5	60
30	3-7 17:05	20°55.0'	121°10.1'	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	25.7	25.0	22.5	18.8	16.2	268	15.4	90
31	3-8 03:45	20°58.0'	120°20.0'	25.2	25.2	24.8	23.6	22.6	22.6	20.3	18.9	18.0	18.0	16.6	13.7	12.7	262	12.7	10
32-1	3-8 15:48	21°29.5'	119°07.5'	24.5	24.5	24.5	24.5	24.1	23.2	21.5	-	-	-	-	-	-	262	13.5	40
35	3-9 23:06	22°25.2'	118°25.6'	24.1	24.1	24.1	24.1	23.2	22.1	20.1	-	-	-	-	-	-	90	21.3	40
39	3-10 18:33	21°56.5'	116°43.1'	23.3	23.3	23.2	23.2	22.1	20.1	-	-	-	-	-	-	-	89	20.0	30
39-1	3-10 23:26	21°52.7'	116°40.1'	23.1	23.1	22.2	22.1	21.1	20.1	-	-	-	-	-	-	-	90	20.0	10
41	3-17 21:42	22°11.8'	115°30.5'	23.2	23.2	23.2	23.2	21.6	-	-	-	-	-	-	-	-	50	21.6	39
44	3-18 18:45	21°42.2'	117°36.6'	24.0	24.0	24.0	24.0	24.0	23.6	21.2	19.6	18.6	16.2	14.8	14.8	14.8	256	14.6	50
44-13	3-19 18:33	21°24.8'	118°09.7'	23.9	23.9	23.9	23.9	23.9	23.1	21.8	20.3	18.6	15.7	13.6	13.6	13.6	261	13.1	68
45	3-19 23:44	21°15.6'	118°32.0'	25.0	25.0	24.9	24.8	24.8	23.4	19.7	18.1	16.0	13.9	12.2	12.2	12.2	270	11.9	60
46	3-20 18:32	21°32.5'	119°07.2'	24.1	24.1	24.1	24.3	21.6	20.2	19.4	18.3	16.8	14.8	12.8	12.8	12.8	268	12.2	20
48	3-22 19:03	26°12.0'	125°41.4'	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.0	23.8	22.5	20.1	17.3	17.3	261	17.2	130
49	3-23 18:58	28°24.5'	128°28.6'	22.2	22.2	22.2	22.2	22.2	22.1	22.1	21.9	21.6	20.0	18.1	18.1	18.1	262	17.6	70

## Appendix-2 KH-73-2 Sampling data

(1)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min.)	Wire angle (°)	Ship speed (kts)	Sample		Bottle No. Plank.	Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish		
2-1	1973 2-22	23:37	27°42.3'N	27°41.2'N	4mφ	150	10	71	1.5	1-2	1-3	E-4	
		00:36	131°25.9'E	131°23.1'E		75	12	63				5	
						0	10	-				6	
2-2	2-23	00:00 00:20	27°42.1' 131°25.4'	27°41.7' 131°24.7'	L.	0	20	-	1.5	1-5	1-4	E-1	1394m <sup>3</sup>
2-3	2-23	00:25 00:35	27°41.5' 131°24.6'	27°41.5' 131°24.4'	L.	0	10	-	1.5	1-7	1-6	E-2 3	865m <sup>3</sup>
3-1	2-23	08:45 14:45	27°00.5' 129°50.5'	27°03.0' 129°38.5'	IKMT	5200	180	-	3	-	1-8 9 10	E-8	net depth 3150m
3-2	2-23	19:17	27°01.9'	20°02.8'	4mφ	150	10	42	1.5	1-15	1-16	E-13	
		20:12	129°41.8'	129°42.4'		75	10	65					
3-3	2-23	19:22	27°01.9'	27°02.1'	L.	0	20	-	1.5	1-12	1-11	E-9 15	1357m <sup>3</sup>
		19:42	129°41.9'	129°41.8'									
3-4	2-23	19:46	27°02.2'	27°02.3'	L.	0	10	-	1.5	1-14	1-13	E-10 11	768m <sup>3</sup>
		19:56	129°41.8'	129°41.7'									
4-1	2-24	01:15	27°09.7'	27°08.5'	4mφ	150	10	75	1.5	2-1	2-4	E-16 17 18	
		02:05	128°40.8'	128°41.2'		75	10	77					
4-2	2-24	01:24	27°09.4'	27°08.9'	L.	0	20	-	1.5	-	2-2	E-20 21	1696m <sup>3</sup>
		01:44	128°40.9'	128°41.2'									
4-3	2-24	01:54 02:04	27°08.8' 128°41.2'	27°08.5' 128°41.2'	L.	0	10	-	1.5	-	2-5	E-19	765m <sup>3</sup>
5-1	2-24	09:55	26°25.7'	26°20.8'	4mφ	500	20	60	1.5	2-7	2-6	E-24 25	
		11:25	128°50.5'	128°51.5'		250	20	60					
5-2	2-24	10:00	Same with 5-1		L.	0	20	-	1.5	-	-	E-23	1945m <sup>3</sup>
		10:20											
5-3	2-24	10:28			L.	0	10	-	1.5	-	-	E-22	992m <sup>3</sup>
		10:38											
6-1	2-24	14:42	25°45.4'	25°42.2'	ORI- 100	2000	10	52	2.0	-	2-8	E-26	Net damaged depth 1220m
		16:27	129°01.2'	129°02.3'		1000	10	59					
6-2	2-24	16:46	25°41.9'	25°38.6'	4mφ	1000	15	62	2.0	2-11	2-12	E-29 30	
		18:33	129°02.6'	129°03.6'		700	15	67					
6-3	2-24	17:32	25°40.8'	25°40.2'	L.	0	20	-	2.0	-	2-9	E-27	1620m <sup>3</sup>
		17:52	129°02.9'	129°03.0'									
6-4	2-24	17:57	25°40.1'	25°39.8'	L.	0	10	-	2.0	-	2-10	E-28	894m <sup>3</sup>
		16:07	129°03.0'	129°03.2'									
6-5	2-24	18:58	25°38.4'	25°41.2'	4mφ	150	15	75	1.5	2-14 15	2-13	E-33 34 35	
		20:21	129°03.7'	129°02.2'		75	17	-					
6-6	2-24	19:00	25°38.8'	25°39.5'	L.	0	20	-	1.5	3-4	3-5	E-31	1494m <sup>3</sup>
		19:20	129°03.7'	129°02.7'									
6-7	2-24	19:24	25°39.6'	25°39.9'	L.	0	10	-	1.5	3-6	3-7	E-32	1073m <sup>3</sup>
		19:34	129°02.7'	129°02.5'									
7-1	2-25	00:20	24°51.4'	24°52.6'	4mφ	150	10	60	1.5	2-16	3-1	E-39 40	
		01:25	129°13.6'	129°14.6'		75	10	60					
7-2	2-25	00:29	24°51.7'	24°52.0'	L.	0	20	-	1.5	-	3-2	E-36 37	2969m <sup>3</sup>
		00:49	129°14.0'	129°14.2'									
7-3	2-25	00:52	24°52.2'	24°52.3'	L.	0	10	-	1.5	-	3-3	E-38	2220m <sup>3</sup>
		01:02	129°14.3'	129°14.4'									
7-4	2-26	00:44	24°51.8'	24°50.7'	4mφ	150	10	53	1.5	3-8	3-9	E-41, 42,43 44	
		01:33	129°09.0'	129°08.2'		75	10	58					
						30	20	-					

## Appendix-2 KH-73-2 Sampling data

(2)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min.)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.			Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish	Plank.	
		1973											
8-1	2-26	06:20 08:43	23°59.1'N 129°06.6'E	23°55.4'N 129°07.2'E	4mφ	1000	30	57	1.5	-	3-12	E-47	
8-2	2-26	06:24 06:44	23°58.9' 129°06.7'	23°58.3' 129°06.8'	L.	0	20	-	1.5	-	3-10	E-45	1455m <sup>3</sup>
8-3	2-26	06:47 06:57	23°58.2' 129°06.8'	23°58.1' 129°06.9'	L.	0	10	-	1.5	-	3-11	E-46	506m <sup>3</sup>
9-1	2-26	13:48 16:18	22°54.9' 128°58.6'	22°46.7' 128°58.0'	ORI	2000 1000 500 300	20 20 20 20	63 62 64 63	2.0	3-13	3-14	E-48	depth 850m 9704m <sup>3</sup>
9-2	2-26	16:20 18:38	22°46.7' 128°58.0'	22°41.3' 128°58.0'	4mφ	1000 700 300 100 50	10 10 20 20 10	64 64 64 62 62	1.5	4-4	4-3	E-51	
9-3	2-26	16:59 17:19	22°44.9' 128°47.9'	22°44.0' 128°58.3'	L.	0	20	-	1.5	-	3-15	E-49	2797m <sup>3</sup>
9-4	2-26	17:21 17:31	22°44.0' 128°58.3'	22°43.5' 128°58.4'	L.	0	10	-	1.5	-	3-16	E-50	923m <sup>3</sup>
10-1	2-26	22:17 23:12	22°00.5' 128°49.6'	22°01.9' 128°48.7'	4mφ	150 75 30	10 10 20	71 77 -	1.5	4-5	4-6	E-54 55	
10-2	2-26	22:22 22:42	Same with 10-1		L.	0	20	-	1.5	4-7	4-8	E-52	1740m <sup>3</sup>
10-3	2-26	22:44 22:54	Same with 10-1		L.	0	10	-	1.5	-	4-9	E-53	895m <sup>3</sup>
10-4	2-26 2-27	23:18 06:00	22°01.9' 128°48.7'	22°16.0' 128°44.0'	4mφ	5000 3000 1500 1000 500	60 30 30 20 20	62 59 66 73 72	1.5	4-11	4-10 12 13	E-56 57 58 59	
11-1	2-27	09:20 11:34	22°45.7' 128°19.5'	22°41.6' 128°18.0'	4mφ	1000 700 300 100 50	10 10 20 20 10	- 66 - 73 -	2.0	4-16	5-1	E-62	
11-2	2-27	09:23 09:43	Same with 11-1		L.	0	20	-	2.0	-	4-14	E-61	1877m <sup>3</sup>
11-3	2-27	09:50 10:00	Same with 11-1		L.	0	10	-	2.0	-	4-15	E-60	1033m <sup>3</sup>
12-1	2-27	15:35 17:47	23°23.8' 127°54.3'	23°25.7' 127°53.2'	4mφ	1000 700 300 100 50	10 10 20 20 10	-	1.5	5-5	5-4	E-66	
12-2	2-27	15:41 16:01	23°23.9' 127°54.3'	23°24.2' 127°54.2'	L.	0	20	-	1.5	-	5-2	E-63 64	1872m <sup>3</sup>
12-3	2-27	16:04 16:14	23°24.2' 127°54.1'	23°24.3' 127°54.0'	L.	0	10	-	1.5	-	5-3	E-65	860m <sup>3</sup>
13-1	2-27	20:48 21:39	23°54.3' 127°35.3'	23°53.2' 127°33.4'	4mφ	150 75 30	10 10 20	- 75 77	1.5	5-6	5-7	E-67 68 69	
13-2	2-27	20:51 21:01	Same with 13-1		L.	0	-	-	1.5	5-10	5-9	E-72 73	992m <sup>3</sup>
13-3	2-27	21:05 21:25	Same with 13-1		L.	0	-	-	-	-	5-8	E-70 71	1901m <sup>3</sup>
13-4	2-27	22:00 23:07	23°53.5' 127°34.0'	23°54.4' 127°35.4'	4mφ	75 30	30 30	65 75	1.5	5-11	5-12	E-74 ~81	

## Appendix-2 KH-73-2 Sampling data

(3)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min.)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.			Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish	Plank.	
	1973												
13-5	2-27 28	23:15	23°54.4'N	24°00.5'N	ORI- 100	2000	20	-	2.0	5-13	5-14	E-82	
		02:03	127°35.4'E	127°31.5'E		1000	20						
						500	20						
						300	10						
14-1	2-28	05:00	24°30.3'	24°34.0'	4mφ	1000	10	-	1.5	6-3	6-2	E-85	
		07:25	127°11.7'	127°15.4'		700	10						
						300	20						
						100	20						
						50	10						
14-2	2-28	05:06 05:26	24°30.4' 127°11.8'	24°31.0' 127°07.3'	L.	0	-	-	1.5	5-16	5-15	E-83	2153m <sup>3</sup>
14-3	2-28	05:28 05:38	24°31.0' 129°07.3'	24°31.2' 127°07.4'	L.		-	-	-	-	6-1	E-84	940m <sup>3</sup>
15-1	2-28	10:30	24°59.8'	25°04.9'	4mφ	1000	10	74	-	6-7	6-6	E-94	
		12:32	126°51.8'	126°51.5'		700	10						
						300	20						
						100	20						
15-2	2-28	10:34 10:44	Same with 15-1		L.	0	-	-	-	-	6-4	E-91	1241m <sup>3</sup>
15-3	2-28	10:52 11:12			L.	0	-	-	-	-	6-5	E-92 93	2275m <sup>3</sup>
15-4	2-28	12:50	25°04.9'	25°07.7'	ORI	2000	-	-	2.0	-	6-8	E-95	3818m <sup>3</sup>
		14:11	126°51.5'	126°51.2'									
16-1	2-28	17:08	25°32.0'	25°28.6'	4mφ	300	30	-	1.5	6-12	6-11	E-89	
		18:32	126°30.9'	126°31.6'		200	30						
16-2	2-28	17:11	25°32.0'	25°31.7'	L.	0	20	-	1.5	-	6-9	E-87	1794m <sup>3</sup>
		17:31	126°30.8'	126°30.3'									
16-3	2-28	17:34	25°31.7'	25°31.6'	L.	0	10	-	1.5	-	6-10	E-88	827m <sup>3</sup>
		17:44	126°30.2'	126°30.1'									
16-4	2-28	18:50	25°28.7'	25°29.7'	4mφ	100	30	-	1.5	6-13	6-14	E-96 97	
		20:02	126°31.6'	126°34.2'		30	30						
16-5	2-28	20:10	25°29.7'	25°28.4'	4mφ	150	10	-	1.5	6-16	6-15	E-98	
		21:02	126°34.2'	126°33.8'		75	10						
						30	30						
16-6	2-28	21:15	25°28.2'	25°24.5'	4mφ	50	60	-	1.5	7-2	7-1	E-99 100	
		22:30	126°33.8'	126°33.5'									
16-7	2-28	22:48	25°24.8'	25°25.8'	4mφ	150	10	54	1.5	7-3	7-4	E-101	
		23:39	126°33.2'	126°32.5'		75	10						
						30	20	-					
16-8	2-28	23:47	25°25.8'	25°27.4'	4mφ	50	60	-	1.5	7-6	7-5	E-102 103	
		29 00:52	126°32.5'	126°30.1'									
16-9	3-1	01:17	25°27.4'	25°28.6'	4mφ	150	10	57	1.5	7-7	7-8	E-104	
		02:05	126°30.1'	126°29.8'		75	10						
						30	20	74					
16-10	3-1	02:17	25°28.6'	25°30.4'	4mφ	50	60	79	1.5	7-9	7-10	E-105 107 108	Two 30m tows
		03:25	126°29.8'	126°29.2'				61					
16-11	3-1	03:32	25°30.4'	25°31.7'	4mφ	150	10	-	2.0	7-11	7-12	E-109	
		04:22	126°29.2'	126°29.2'		75	10						
						30	20						
16-12	3-1	04:34	25°31.7'	25°30.0'	4mφ	50	60	-	1.5	7-13	7-14	E-110 ~112	Two 30m tows
		06:14	126°29.1'	126°29.6'									
17-1	3-1	08:08	25°09.8'	25°04.8'	4mφ	1000	10	-	1.5	8-2	8-1	E-115	
		10:35	126°30.3'	126°29.5'		700	10						
						300	20						
						100	10						
						50	10						
17-2	3-1	08:10 08:30	Same with 17-1		L.	0	20	-	1.5	-	7-15	E-113	2207m <sup>3</sup>
17-3	3-1	08:35 08:45			L.	0	10	-	1.5	-	7-16	E-114	841m <sup>3</sup>

## Appendix-2 KH-73-2 Sampling data

(4)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min.)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.			Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish	Plank.	
18-1	1973 3-1	19:37	24°47.3'N	24°47.3'N	4mφ	150	10	73	1.5	8-8	8-7	E-118	
		20:34	126°26.3'E	126°25.6'E		75	10	75					
						30	20	79					
18-2	3-1	19:42	24°47.2'	24°47.1'	L.	0	10	-	1.5	8-3	8-4	E-200	944m <sup>3</sup>
		19:52	126°26.2'	126°26.3'									
18-3	3-1	19:55	24°47.1'	24°47.2'	L.	0	20	-	1.5	8-5	8-6	E-117	1783m <sup>3</sup>
		20:15	126°26.3'	126°26.0'									
18-4	3-1	20:59	24°46.8'	24°46.3'	4mφ	30	30	-	1.5	8-9	8-10	E-120	
		21:29	126°25.7'	126°25.2'									
18-5	3-1	21:44	24°46.2'	24°45.1'	4mφ	150	10	75	1.5	8-11	8-12	E-122	
		22:34	126°25.1'	126°24.9'		75	10	74					
						30	20	79					
18-6	3- 2	22:34	24°45.0'	24°43.4'	4mφ	30	20	78	1.5	8-14	8-13	E-124	
		00:06	126°24.9'	126°24.4'			30	30					
18-7	3-2	00:46	24°42.7'	24°41.0'	4mφ	150	10	65	1.5	9-1	9-2	E-127	
		01:39	126°24.1'	126°23.9'		75	11	-					
18-8	3-2	01:46	24°41.0'	24°38.5'	4mφ	30	60	-	1.5	9-3	9-4	E-128	
		03:04	126°23.9'	126°23.9'									
18-9	3-2	03:10	24°38.5'	24°36.6'	4mφ	150	10	-	1.5	9-6	9-5	E-131	
		04:10	126°23.9'	126°23.9'		75	10	-					
18-10	3-2	04:15	24°36.5'	24°34.0'	4mφ	30	60	-	1.5	9-8	9-7	E-133,134	
		05:45	126°23.9'	126°24.7'									
19-1	3-2	08:39	23°58.5'	23°52.0'	ORI	2000	20	62	1.5	9-10	9-9	E-137	
		11:27	126°29.3'	126°28.5'		1000	20	65					
						700	20	59					
19-2	3-2	11:36	23°51.9'	23°48.2'	4mφ	1000	20	71	1.5	9-11	9-12	E-138	
		13:45	126°28.5'	126°26.5'		700	20	68					
						300	20	63					
20-1	3-2	18:30	23°08.2'	23°08.6'	4mφ	150	10	-	1.5	9-16	10-1	E-141	
		19:24	126°28.6'	126°30.4'		75	10	-					
20-2	3-2	17:25	23°08.8'	23°08.6'	L.	0	20	-	1.5	9-13	9-14	E-139	1288m <sup>3</sup>
		17:45	126°30.0'	126°29.2'									
20-3	3-2	18:31	23°08.2'	23°08.0'	L.	0	10	-	1.5	-	9-15	E-140	831m <sup>3</sup>
		18:41	126°28.6'	126°29.1'									
20-4	3-2	19:32	23°08.4'	23°08.5'	4mφ	30	30	-	1.5	10-2	10-3	E-143	
		20:06	126°30.2'	126°29.2'									
20-5	3-2	20:15	23°08.5'	23°08.7'	4mφ	75	30	-	1.5	10-5	10-4	E-145	
		20:55	126°29.1'	126°28.1'									
20-6	3-2	21:00	23°08.7'	23°08.5'	4mφ	30	30	-	1.5	10-7	10-6	E-147	
		21:40	126°28.0'	126°27.1'									
20-7	3-2	21:48	23°08.4'	23°07.8'	4mφ	30	30	-	1.5	10-9	10-8	E-150	
		22:25	126°27.0'	126°26.3'									
20-8	3-2	22:30	23°07.8'	23°07.6'	4mφ	75	30	63	1.5	10-11	10-10	E-152	
		23:12	126°26.3'	126°25.7'									
20-9	3-2	23:16	23°07.6'	23°07.1'	4mφ	30	30	63	1.5	10-12	10-13	E-154	
		23:52	126°25.6'	126°25.1'									

## Appendix-2 KH-73-2 Sampling data

(5)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.		Remarks & Filtered water volume	
			Net in	Net out						Lept.	Fish Plank.		
20-10	1973 3-3	00:02	23°07.1'N	23°06.8'N	4mφ	30	30	-	1.5	10-15	10-14	E-155 156,157	
		00:38	126°25.1'E	126°24.0'E									
20-11	3-3	00:46	23°06.8'	23°06.2'	4mφ	75	30	71	1.5	10-16	11-1	E-158 159	
		01:18	126°24.0'	126°23.6'									
20-12	3-3	01:52	23°05.8'	23°05.3'	4mφ	30	30	70	1.5	11-2	11-3	E-160	
		02:25	126°23.2'	126°23.2'									
20-13	3-3	02:47	23°05.3'	23°04.4'	4mφ	30	30	64	1.5	11-4	11-5	E-161 162	
		03:19	126°23.2'	126°23.1'									
20-14	3-3	03:31	23°04.4'	22°56.6'	4mφ	5000	60	47	2.0	11-6	11-7	E-163 164	
		09:09	126°23.1'	126°25.7'		3000	30	58					1500
21-1	3-3	13:50	22°00.5'	22°10.4'	IKMT	4000	75	-	3.0	11-9	11-8	E-165	net depth 1550 m
		19:30	126°31.0'	126°14.7'									
21-2	3-3	19:44	22°10.8'	22°11.6'	4mφ	150	10	71	1.5	11-14	11-15	E-169	
		20:38	126°14.7'	126°16.3'		75	10	68					
21-3	3-3	19:46	22°10.8'	22°11.1'	L.	0	10	-	1.5	11-11	11-10	E-167	930m <sup>3</sup>
		19:56	126°14.6'	126°14.7'									
21-4	3-3	19:59	22°11.1'	22°11.4'	L.	0	20	-	1.5	11-12	11-13	E-168	1631m <sup>3</sup>
		20:19	126°14.8'	126°15.7'									
21-5	3-3	20:48	22°11.6'	22°12.0'	4mφ	30	30	-	1.5	11-16	12-1	E-170 171	
		21:24	126°16.3'	126°17.1'									
21-6	3-3	21:33	22°12.0'	22°11.9'	4mφ	75	30	75	1.5	12-2	12-3	E-166	
		22:05	126°17.2'	126°18.8'									
21-7	3-3	22:15	22°11.9'	22°12.2'	4mφ	30	30	73	1.5	12-4	12-5	E-172 173	
		22:46	126°18.8'	126°19.5'									
21-8	3-3	22:56	22°12.2'	22°12.5'	4mφ	30	30	75	1.5	12-6	12-7	E-174 175	
		23:27	126°19.5'	126°20.5'									
21-9	3- 4	23:37	22°12.5'	22°12.5'	4mφ	75	30	-	1.5	12-8	12-9	E-176	
		00:12	126°20.5'	126°22.5'									
21-10	3-4	00:18	22°12.5'	22°11.8'	4mφ	30	30	-	1.5	12-10	12-11	E-177	
		00:53	126°22.5'	126°23.0'									
21-11	3-4	01:00	22°11.8'	22°10.8'	4mφ	30	30	-	1.5	12-12	12-13	E-178	
		01:35	126°23.0'	126°24.0'									
21-12	3-4	01:40	22°10.8'	22°10.0'	4mφ	75	30	-	1.5	12-15	12-14	E-179	
		02:22	126°24.0'	126°25.0'									
21-13	3-4	02:33	22°10.8'	22°09.0'	4mφ	30	30	-	1.5	13-1	12-16	E-182	
		03:07	126°25.0'	126°25.8'									
21-14	3-4	03:15	22°09.0'	22°08.0'	4mφ	30	30	-	1.5	13-3	13-2	E-183	
		03:40	126°25.8'	126°27.0'									
21-15	3-4	03:54	22°08.0'	22°06.8'	4mφ	75	30	66	1.5	13-4	13-5	E-184	
		04:34	126°27.0'	126°27.0'									
21-16	3-4	04:41	22°06.7'	22°05.7'	4mφ	30	30	78	1.5	13-7	13-6	E-185	
		05:16	126°27.0'	126°27.2'									
21-17	3-4	05:25	22°05.6'	22°04.7'	4mφ	30	30	78	1.5	14-1	14-2	E-186	
		05:59	126°27.3'	126°27.6'									
22-1	3-4	11:10	22°34.7'	22°37.7'	4mφ	1000	20	52	1.5	14-6	14-5	E-189	
		13:03	125°31.9'	125°29.3'		700	20	55					
22-2	3-4	11:13	22°34.8'	22°35.0'	L.	0	20	-	1.5	-	14-3	E-187	1736m <sup>3</sup>
		11:33	125°31.8'	125°31.4'									
22-3	3-4	11:36	22°35.0'	22°35.1'	L.	0	10	-	1.5	-	14-4	E-188	723m <sup>3</sup>
		11:46	125°31.4'	125°31.0'									
23-1	3-4	18:23	23°09.7'	23°09.2'	4mφ	150	10	-	1.5	14-9	14-10	E-192	
		19:20	124°34.9'	124°34.5'		75	10	-					
23-2	3-4	18:25	23°09.6'	23°09.5'	L.	0	20	-	1.5	-	14-7	E-190	1926m <sup>3</sup>
		18:45	124°34.8'	124°34.7'									
23-3	3-4	18:49	23°09.5'	23°09.4'	L.	0	10	-	1.5	-	14-8	E-191	937m <sup>3</sup>
		18:59	124°34.7'	124°34.6'									

## Appendix-2 KH-73-2 Sampling data

(6)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.			Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish	Plank.	
23-4	1973 3-4	19:31 20:09	—	—	4mφ	30	30	-	1.5	14-11	14-12	E-193	
23-5	3-4	20:15 20:50	—	23°13.1'N 124°35.3'E	4mφ	75	30	-	1.5	14-14	14-13	E-194	
23-6	3-4	20:55 21:30	23°13.1'N 124°35.3'E	23°14.6' 124°36.0'	4mφ	30	30	-	1.5	14-16	14-15	E-195 196	
23-7	3-4	21:35 22:10	23°14.6' 124°36.0'	23°15.8' 124°36.7'	4mφ	30	30	-	1.5	14-18	14-17	E-197 198	
23-8	3-4	22:15 22:52	23°15.9' 124°36.8'	23°17.4' 124°36.9'	4mφ	75	30	70	1.5	14-19	14-20	E-199	
23-9	3-4	22:58 23:33	23°17.5' 124°36.9'	23°18.7' 124°36.9'	4mφ	30	30	72	1.5	14-21	14-22	E-201	
23-10	3- 5	23:36 00:13	23°18.8' 124°37.0'	23°19.3' 124°37.0'	4mφ	30	30	76	1.5	14-24	14-23	E-203 204	
23-11	3-5	00:18 00:51	23°19.3' 124°37.1'	23°20.3' 124°37.2'	4mφ	75	30	44	1.5	14-25	15-1	E-205	
23-12	3-5	00:58 01:29	23°30.3' 124°37.2'	23°20.3' 124°36.8'	4mφ	30	30	64	1.5	15-2	15-3	E-206 207	
23-13	3-5	01:37 02:09	23°20.3' 124°36.8'	23°20.4' 124°36.2'	4mφ	30	30	60	1.5	15-4	15-5	E-208 209	
24-1	3-5	17:56 20:02	23°43.5' 123°46.9'	23°44.8' 123°49.0'	4mφ	1000 700 300 100	20 20 20 10	- 63 -	2.0	15-8	15-9	E-212	
24-2	3-5	18:05 18:25	23°43.4' 123°47.1'	23°43.7' 123°47.3'	L.	0	20	-	1.5	-	15-6	E-210	1972m <sup>3</sup>
24-3	3-5	18:28 18:38	23°43.7' 123°47.3'	23°43.8' 123°47.4'	L.	0	10	-	2.0	-	15-7	E-211	916m <sup>3</sup>
25-1	3-5	21:55 23:58	23°46.5' 123°27.2'	23°42.3' 123°27.2'	4mφ	700 500 300 150	20 20 20 20	- - - -	1.5	15-13	15-12	E-215 216	
25-2	3-5	21:56 22:16			L.	0	20	-	1.5	-	15-10	E-213	1824m <sup>3</sup>
25-3	3-5	22:18 22:28	Same with 25 - 1		L.	0	10	-	1.5	-	15-11	E-214	766m <sup>3</sup>
25-4	3-6	00:04 00:40	23°42.3' 123°27.2'	23°41.3' 123°27.2'	4mφ	75	30	-	1.5	15-15	15-14	E-217 218	
25-5	3-6	00:45 01:19	23°41.3' 123°27.2'	23°40.3' 123°26.9'	4mφ	75	30	76	1.5	15-16	15-17	E-219 220	
25-6	3-6	01:30 02:02	23°40.3' 123°26.9'	23°41.3' 123°26.9'	4mφ	30	30	-	1.5	15-18	15-19	E-221 222	
25-7	3-6	02:14 02:47	23°41.3' 123°26.6'	23°42.0' 123°26.2'	4mφ	30	30	75	1.5	15-20	15-21	E-223	
25-8	3-6	03:11 03:43	23°41.8' 123°26.1'	23°42.0' 123°25.5'	4mφ	75	30	63	1.5	-	15-22	E-224	
25-9	3-6	03:59 04:30	23°42.0' 123°25.5'	23°42.6' 123°25.1'	4mφ	30	30	64	1.5	15-24	15-23	E-225 226	
25-10	3-6	04:44 05:15	23°42.6' 123°25.1'	23°41.9' 123°24.4'	4mφ	30	30	71	1.5	16-1	15-25	E-227	
26-1	3-6	08:30 10:48	23°03.0' 123°26.3'	22°57.3' 123°23.8'	4mφ	1000 700 300 100	20 20 20 10	- - 65 75	2.0	16-5	16-4	E-230	
26-2	3-6	08:35 08:55	Same with 26 - 1		L.	0	20	-	2.0	-	16-2	E-228	2116m <sup>3</sup>
26-3	3-6	08:59 09:09			L.	0	10	-	2.0	-	16-3	E-229	962m <sup>3</sup>
27-1	3-6	14:45 20:50	22°05.8' 123°27.0'	21°54.8' 123°08.0'	IKMT	4000	225	63	4.0 3.0	-	16-6	E-241 242	net depth 0 - 1625 m

## Appendix-2 KH-73-2 Sampling data

(7)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.			Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish	Plank.	
27-2	1973 3-6	* 20:00 21:16	21°54.6'N 123°07.8'E	21°53.5'N 123°03.7'E	ORI	2000	93	-	2.0	16-11	16-10	E-245	net depth 0 - 950 m
27-3	3-6	21:23 22:16	21°53.4' 123°03.8'	21°52.7' 123°01.4'	4mφ	150 75 30	10 10 20	- - -	1.5	16-12	16-13	E-246 247	
27-4	3-6	20:06 20:16	Same with 27-3		L.	0	10	-	1.5	-	16-7	E-243	900m <sup>3</sup>
27-5	3-6	20:19 20:39	Same with 27-3		L.	0	20	-	1.5	16-8	16-9	E-244	1760m <sup>3</sup>
27-6	3-6	22:24 22:57	21°52.6' 123°01.3'	21°52.0' 122°59.8'	4mφ	75	30	56	1.5	16-15	16-14	E-248	
27-7	3-6	23:06 23:38	21°52.0' 122°59.8'	21°51.7' 122°58.0'	4mφ	30	30	64	1.5	16-17	16-16	E-249	
27-8	3-7	23:46 00:23	21°51.7' 122°58.0'	21°51.2' 122°56.0'	4mφ	75	30	54	2.0	16-18	16-19	E-250	
27-9	3-7	00:28 01:03	21°51.2' 122°56.0'	21°51.0' 122°54.0'	4mφ	30	30	-	2.0	16-20	16-21	E-251	
27-10	3-7	01:08 01:45	21°51.0' 122°54.0'	21°50.7' 122°52.2'	4mφ	75	30	-	1.5	16-23	16-22	E-252	
27-11	3-7	01:46 02:23	21°50.7' 122°52.2'	21°50.6' 122°50.2'	4mφ	30	30	-	1.5	16-25	16-24	E-253	
27-12	3-7	02:27 03:05	21°50.6' 122°50.2'	21°50.6' 122°48.5'	4mφ	75	30	54	1.5	17-1	17-2	E-254	
27-13	3-7	03:11 03:45	21°50.6' 122°48.5'	21°50.5' 122°46.7'	4mφ	30	30	-	1.5	17-3	17-4	E-255 256	
29-1	3-7	08:22 10:19	21°20.2' 121°55.3'	21°20.2' 121°55.3'	4mφ	1000 700 300 100	20 20 20 10	62 64 55 42	1.5	17-8	17-7	E-259	
29-2	3-7	08:25 08:45	Same with 29-1		L.	0	20	-	1.5	-	17-5	E-257	1667m <sup>3</sup>
29-3	3-7	08:48 08:58	Same with 29-1		L.	0	10	-	1.5	-	17-6	E-258	882m <sup>3</sup>
29-4	3-7	10:35 13:11	21°20.2' 121°55.3'	21°18.3' 121°53.3'	ORI	2000 1000 700 500	20 20 20 20	- 51 48 -	2.0	-	17-9	E-260	
30-1	3-7	17:15 18:08	20°55.0' 121°10.0'	20°55.9' 121°08.1'	4mφ	150 75 30	10 10 20	52 - -	1.5	17-13	17-12	E-263	
30-2	3-7	17:17 17:37	20°55.1' 121°09.7'	20°55.3' 121°09.1'	L.	0	20	-	-	-	17-10	E-261	1518m <sup>3</sup>
30-3	3-7	17:39 17:49	20°55.3' 121°09.1'	20°55.6' 121°08.8'	L.	0	10	-	-	-	17-11	E-262	705m <sup>3</sup>
30-4	3-7	18:16 18:50	20°56.0' 121°08.0'	20°57.2' 121°06.6'	4mφ	30	30	-	-	17-15	17-14	E-264	
30-5	3-7	19:00 19:37	20°57.4' 121°06.3'	20°58.4' 121°05.0'	4mφ	75	30	69	-	17-16	17-17	E-265 266	
30-6	3-7	19:47 20:21	20°58.5' 121°04.9'	20°59.3' 121°03.2'	4mφ	30	30	72	-	17-19	17-18	E-267 268	
30-7	3-7	20:27 21:01	20°59.4' 121°03.1'	21°00.4' 121°02.2'	4mφ	30	30	70	-	17-20	17-21	E-269 270	
30-8	3-7	21:07 21:40	21°00.4' 121°02.2'	21°01.4' 121°00.8'	4mφ	75	30	69	1.5	17-23	17-22	E-271	
30-9	3-7	21:49 22:20	21°01.4' 121°00.8'	—	4mφ	30	30	75	1.5	17-25	17-24	E-272	
30-10	3-7	22:30 23:01	—	21°03.7' 120°57.1'	4mφ	30	30	75	1.5	18-2	18-1	E-273	
30-11	3-7	23:08 23:43	21°03.8' 120°57.0'	21°04.7' 120°55.3'	4mφ	30	30	-	1.5	18-3	18-4	E-274	
30-12	3-7 3-8	23:49 01:50	21°04.7' 120°55.2'	21°04.8' 120°53.0'	ORI	1690	-	-	2.0	-	18-5	-	Net damaged



## Appendix-2 KH-73-2 Sampling data

(8)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.			Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish	Plank.	
31-1	1973 3-8	03:50	20°58.0'N	21°00.9'N	4mφ	1000	20	55	1.5	18-10	18-9	E-277	
		06:10	120°20.0'E	120°17.4'E		700	20	62					
31-2	3-8	03:55	20°58.7'	20°58.8'	L.	0	20	-	1.5	18-7	18-6	E-275	1641m <sup>3</sup>
		04:15	120°19.7'	120°19.7'									
31-3	3-8	04:17	20°58.9'	20°59.0'	L.	0	10	-	1.5	-	18-8	E-276	967m <sup>3</sup>
		04:27	120°19.7'	120°19.7'									
31-4	3-8	06:20	21°01.1'	21°02.3'	ORI	2000	20	56	2.0	-	18-11	E-291	
		08:59	120°17.1'	120°12.1'		1000	20	59					
32-1	3-8	15:53	21°29.5'	21°30.6'	ORI	2000	20	43	2.0	18-13	18-12	E-279	
		18:31	119°07.5'	119°12.3'		1000	20	62					
32-2	3-8	19:11	21°29.8'	21°29.8'	4mφ	150	10	75	1.5	18-15	18-16	E-280	
		20:05	119°11.3'	119°12.8'		75	10	-					
34-1	3-9	14:35	22°10.2'	22°07.3'	4mφ	1000	20	54	1.5	18-20	18-19	E-294	
		16:43	118°37.5'	118°38.2'		700	20	66					
34-2	3-9	19:07	22°06.4'	22°05.7'	4mφ	75	30	63	1.5	18-22	18-23	E-297	
		19:49	118°35.3'	118°35.8'									
34-3	3-9	19:52	22°05.7'	22°04.8'	4mφ	30	30	-	1.5	19-1	18-25	E-298	
		20:30	118°35.9'	118°36.7'									
34-4	3-9	20:32	22°04.8'	22°03.9'	4mφ	30	30	-	1.5	19-3	19-5	E-299	
		21:10	118°36.7'	118°37.8'									
35-1	3-9	23:10	22°25.2'	22°24.7'	4mφ	75	30	-	1.5	19-6	19-8	E-301	
		23:50	118°25.6'	118°24.5'									
35-2	3-9	23:53	22°24.7'	22°25.1'	4mφ	30	30	-	1.5	19-10	19-9	E-302	
		00:30	118°24.5'	118°23.2'									
35-3	3-10	00:32	22°25.1'	22°24.8'	4mφ	30	30	-	1.5	19-12	19-11	E-303	
		01:07	118°23.2'	118°22.8'									
39-1	3-10	18:46	21°56.4'	21°56.5'	4mφ	75	30	69	1.5	19-16	19-15	E-307	
		19:24	116°43.0'	116°42.0'									
39-2	3-10	18:48	21°56.4'	21°56.5'	L.	0	10	-	1.5	19-14	19-13	E-306	789m <sup>3</sup>
		18:58	116°42.8'	116°42.6'									
39-3	3-10	19:33	21°56.5'	21°56.5'	4mφ	30	30	67	1.5	19-19	19-20	E-310	
		20:07	116°41.3'	116°41.4'									
39-4	3-10	19:11	21°56.5'	21°56.5'	L.	0	20	-	1.5	19-18	19-17	E-308	2324m <sup>3</sup>
		19:31	116°42.4'	116°42.0'									
39-5	3-10	20:35	21°56.6'	21°56.6'	4mφ	30	30	-	1.5	19-21	19-22	E-304	
		21:09	116°42.0'	116°40.1'									
39-6	3-10	21:18	21°56.5'	21°55.8'	4mφ	30	30	65	1.5	19-25	19-23	E-305	
		21:49	116°40.1'	116°40.1'									
39-7	3-10	21:58	21°55.7'	21°54.5'	4mφ	75	30	70	2.0	20-2	20-1	E-311	
		22:33	116°40.1'	116°40.1'									
39-8	3-10	22:43	21°54.4'	21°52.7'	4mφ	150	30	60	1.5	20-4	20-3	E-312	
		23:18	116°40.1'	116°40.1'									
39-9	3-10	23:34	21°52.8'	21°53.0'	4mφ	30	30	-	1.5	20-6	20-5	E-313	
		00:09	116°40.1'	116°39.2'									
39-10	3-11	00:14	21°53.0'	21°53.3'	4mφ	75	30	-	1.5	20-7	20-8	E-314	
		00:52	116°39.2'	116°38.3'									
39-11	3-11	00:58	21°53.3'	21°53.5'	4mφ	30	30	-	2.0	20-9	20-10	E-315	
		01:32	116°38.3'	116°37.4'									
41-1	3-17	22:00	22°12.2'	22°12.7'	4mφ	50	30	-	1.5	20-12	20-11	E-318	
		22:40	115°30.9'	115°31.5'									
41-2	3-17	22:07	Same with 41-1		L.	0	20	-	1.5	20-17	20-16	E-316	1120m <sup>3</sup>
		22:27											
41-3	3-17	22:30	Same with 41-1		L.	0	10	-	1.5	-	20-13	E-317	481m <sup>3</sup>
	22:40												

## Appendix-2 KH-73-2 Sampling data

(9)

Sta.	Date	Time	Locality		Type or Net	Wire out (m)	Towing duration (min)	Wire angle (°)	Ship speed (kts)	Sample Bottle No.		Remarks & Filtered water volume
			Net in	Net out						Lept. Fish	Plank.	
41-4	1973 3-17	22:45 23:25	22°12.7'N 115°31.5'E	22°13.4'N 115°32.0'E	4mφ	30	30	-	1.5	20-15 20-14	E-319 320	
44-1	3-18	18:52 19:52	21°42.1' 117°36.7'	21°42.6' 117°37.4'	4mφ	150 75 30	10 13 20	72 77 -	1.5	20-23 24	20-25 E-324 325	
44-2	3-18	18:55 19:05	21°42.1' 117°36.8'	21°42.3' 117°36.9'	L.	0	10	-	1.5	20-18 20-19	E-327	941m <sup>3</sup>
44-3	3-18	19:08 19:28	21°42.3' 117°36.9'	21°42.5' 117°37.3'	L.	0	20	-	1.5	20-20 21	20-22 E-322 323	1896m <sup>3</sup>
44-4	3-18	20:02 20:41	21°42.6' 117°37.4'	21°42.5' 117°38.9'	4mφ	30	30	-	1.5	21-1 2	21-3 E-326, 328 329, 410	
44-5	3-18	20:46 21:22	21°42.5' 117°39.0'	21°42.8' 117°39.7'	4mφ	75	30	64	1.5	21-5 21-4	E-330 331, 332	
44-6	3-18	21:30 22:02	21°42.8' 117°39.8'	21°42.9' 117°40.4'	4mφ	30	30	59	1.5	21-7 8	21-6 E-333 334	
44-7	3-18	22:11 22:43	21°42.9' 117°40.5'	21°43.3' 117°41.3'	4mφ	30	30	75	1.5	21-10 11	21-9 E-335 336	
44-8	3-18	22:51 23:31	21°43.3' 117°41.4'	21°43.7' 117°42.2'	4mφ	75	30	-	1.5	21-12 21-13	E-337 338, 339	
44-9	3-18 19	23:33 00:09	21°43.7' 117°42.3'	21°44.0' 117°43.2'	4mφ	30	30	-	1.5	21-14 16	21-15 E-340 341	
44-10	3-19	00:12 00:48	21°44.0' 117°43.2'	21°44.6' 117°43.9'	4mφ	30	30	-	1.5	21-17 21-18	E-342 343, 344	
44-11	3-19	00:50 01:25	21°44.6' 117°43.9'	21°45.7' 117°44.3'	4mφ	30	30	-	1.5	21-20 21-19	E-345 346	
44-12	3-19	01:40 02:05	21°46.0' 117°44.6'	21°46.1' 117°45.5'	ORI -100	500	25	42	1.5	- 21-21	E-347	
44-13	3-19	18:45 19:40	21°24.6' 118°09.9'	21°24.6' 118°11.4'	4mφ	150 75 30	10 10 20	- - 75	1.5	22-2 22-3 4	E-351, 354~ 362	
44-14	3-19	18:48 18:58	21°24.6' 118°10.0'	21°24.4' 118°10.3'	L.	0	10	-	1.5	21-24 21-22 23	E-348	884m <sup>3</sup>
44-15	3-19	19:06 19:26	21°24.3' 118°10.4'	21°24.3' 118°10.9'	L.	0	20	-	1.5	21-25 22-1	E-352 349, 350	1747m <sup>3</sup>
44-16	3-19	19:49 20:20	21°24.6' 118°11.5'	21°25.7' 118°11.9'	4mφ	30	30	-	1.5	22-6 22-5	E-363~ 367	
44-17	3-19	20:30 21:00	21°25.8' 118°12.0'	21°26.1' 118°12.7'	4mφ	30	30	78	1.5	22-7 22-8	E-368 369, 370	
44-18	3-19	21:09 21:42	21°26.2' 118°12.8'	21°27.0' 118°14.0'	4mφ	75	30	67	1.5	22-9 22-10	E-371 ~ 374	
45-1	3-19 20	23:52 00:49	21°15.5' 118°32.2'	21°15.0' 118°33.9'	4mφ	150 75 30	10 10 20	- - -	1.5	22-16 22-15	E-377	
45-2	3-20	00:00 00:20	21°15.4' 118°32.3'	21°15.2' 118°32.9'	L.	0	20	-	1.5	22-12 22-11	E-375	1536m <sup>3</sup>
45-3	3-20	00:23 00:33	21°15.2' 118°32.9'	21°15.2' 118°33.5'	L.	0	10	-	1.5	22-14 22-13	E-376	894m <sup>3</sup>
45-4	3-20	00:58 02:12	21°15.0' 118°34.0'	21°14.1' 118°36.8'	ORI	2000	74	59	2.0	22-18 22-17	E-378	
46-1	3-20	18:40 19:40	21°32.5' 119°07.3'	21°32.8' 119°10.9'	4mφ	150 75 30	10 10 20	- - -	1.5	23-1 22-25	E-387 388	
46-2	3-20	18:44 19:04	21°32.5' 119°17.4'	21°32.6' 119°08.0'	L.	0	20	-	1.5	22-20 22-19	E-380 381	1894m <sup>3</sup>
46-3	3-20	20:25 20:35	—	—	L.	0	10	-	1.5	22-24 22-23	E-386	775m <sup>3</sup>
46-4	3-20	19:43 20:20	21°32.8' 119°11.0'	21°33.3' 119°12.9'	4mφ	30	30	-	1.5	23-3 23-2	E-389, 390 401~ 404	
46-5	3-20	20:23 20:59			4mφ	30	30	-	1.5	22-22 22-21	E-382 ~ 385	
48-1	3-22	19:12 20:03	26°12.1' 125°41.5'	26°13.7' 125°43.4'	4mφ	150 75 30	10 10 20	54 66 78	1.5	23-6 23-8	E-407	

## Appendix-2 KH-73-2 Sampling data

(10)

Sta.	Date	Time	Locality		Type of Net	Wire out (m)	Towing duration (min)	Wire angle (°)	Ship speed (kts)	sample Bottle No.			Remarks & Filtered water volume
			Net in	Net out						Lept.	Fish	Plank.	
48-2	1973 3-22	19:18	26°12.3'N	26°12.6'N	L.	0	20	-	1.5	23-5	23-4	E-405	1629m <sup>3</sup>
		19:38	125°41.8'E	125°42.2'E									
48-3	3-22	19:42	26°12.7'	26°13.0'	L.	0	10	-	1.5	-	23-7	E-406	677m <sup>3</sup>
		19:52	125°42.3'	125°42.6'									
48-4	3-22	20:12	26°13.7'	26°14.0'	4mφ	30	30	83	1.5	23-9	23-10	E-408	
		20:43	125°43.3'	125°44.2'									
48-5	3-22	20:50	26°14.0'	26°15.3'	4mφ	30	30	73	2.0	23-12	23-11	E-409	
		21:25	125°44.2'	125°46.2'									
48-6	3-22	21:29	26°15.3'	26°16.3'	4mφ	75	30	65	2.0	23-14	23-13	E-421 423	Net damaged
		22:07	125°46.2'	125°47.2'									
48-7	3-22	22:40	26°17.4'	26°17.8'	4mφ	30	30	75	1.5	23-16	23-15	E-424	
		23:14	125°48.0'	125°48.6'									
49-1	3-23	19:07	28°24.6'	28°25.1'	4mφ	150 75 30	10 10 20	-	1.5	23-19	23-18	E-426 427	
		20:05	128°28.7'	128°29.5'									
49-2	3-23	19:11	28°24.7'	28°25.0'	L.	0	20	-	1.5	-	23-17	E-425	
		19:31	128°28.8'	128°29.3'									
49-3	3-23	19:34	28°25.0'	28°25.0'	L.	0	10	-	1.5	-	23-20	E-428	
		19:44	128°29.3'	128°29.5'									
49-4	3-23	20:06	28°25.1'	28°25.3'	4mφ	30	30	-	1.5	23-21	23-22	E-429 430	
		20:38	128°29.5'	128°32.3'									
49-5	3-23	20:45	28°25.4'	28°25.5'	4mφ	30	30	-	1.5	23-23	23-24	E-431 432	
		21:18	128°32.4'	128°33.0'									
49-6	3-23	21:22	28°25.5'	28°25.6'	4mφ	75	30	-	1.5	23-25	24-1	E-433 434	
		21:59	128°33.0'	128°34.1'									
49-7	3-23	22:05	28°25.6'	28°26.2'	4mφ	30	30	-	1.5	24-2	24-3	E-435	
		22:36	128°34.2'	128°34.5'									
49-8	3-23	22:42	28°26.2'	28°26.0'	4mφ	30	30	-	1.5	24-4	24-5	E-436	
		23:13	128°34.5'	128°35.2'									
49-9	3-23	23:21	28°26.0'	28°26.2'	4mφ	75	30	-	1.5	24-6	24-7	E-437	
		23:52	128°35.2'	128°36.2'									

## General remarks.

- 1) The time indicates times of net in and out.
- 2) 4mφ net is used mainly at the surface of the sea.
- 3) The mid points of locality may be used as the net operation points.
- 4) The quantity (m<sup>3</sup>) in remarks indicates the water volume filtered.